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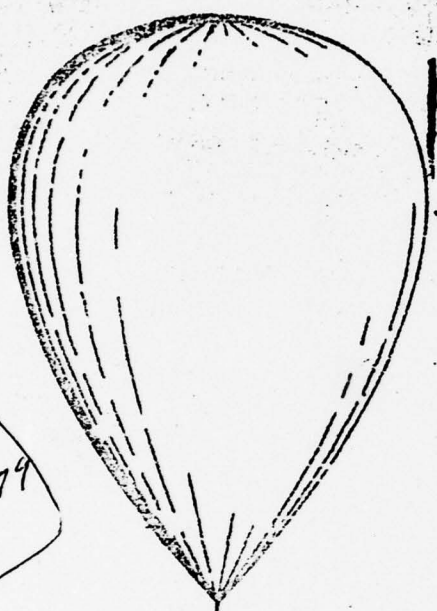
PLUMBBOB #21

ON-SITE RAD-SAFETY REPORT



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REYNOLDS ELECTRICAL AND ENGINEERING CO., INC.
HEALTH AND SAFETY DEPARTMENT
RADIOLOGICAL SAFETY DIVISION

NEVADA TEST SITE
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REYNOLDS ELECTRICAL & ENGINEERING CO., INC.
Mercury, Nevada

MEMORANDUM

July 15, 1958

TO: Distribution

FROM: Radiological Safety & Technical Services Department

SUBJECT: Transmittal of PLUMBBOB Report

Transmitted herewith is the On-Site Rad-Safety Support Report for Operation PLUMBBOB.

This report is a resume' of procedures and activities of the Reynolds Electrical and Engineering Company, Inc., Rad-Safe Division in providing Radiological Safety support on the Nevada Test Site during the PLUMBBOB Operation.

William S. Johnson
William S. Johnson

FWW:ja
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OPERATION PLUMBBOB

ON-SITE RADIOLOGICAL SAFETY SUPPORT REPORT

COMPILED AND EDITED

BY

Members of the Reynolds Electrical & Engineering Company, Incorporated, Radiological Safety Division. Superintendent, Floyd W. Wilcox, with the assistance of Mr. Roscoe H. Goeke and Mr. Charles L. Weaver, Albuquerque Operations Office, AEC.

Albuquerque, New Mexico

OPERATION PLUMBBOB

ON-SITE RADIOLOGICAL SAFETY SUPPORT REPORT

Introduction

The primary mission of the Reynolds Electrical and Engineering Company, Incorporated, Radiological Safety Division during Operation Plumbbob was safeguarding test personnel from unnecessary exposure to radiation, preventing the spread of contamination from test areas and disseminating current documented information on radiological conditions at the Nevada Test Site.

TABLE OF CONTENTS

ILLUSTRATIONS

CHAPTER I

Organization and Responsibilities

1.1 On-site rad-safety support was furnished by the Support Director, with the Support Contractor, Reynolds Electrical and Engineering Company, Incorporated, (REECO), providing the necessary services.

The on-site rad-safety responsibility in the forward area was delegated by the Test Manager to the Test Director. Support services were the responsibility of REECO.

The operational chart showing the rad-safety organization is as follows:

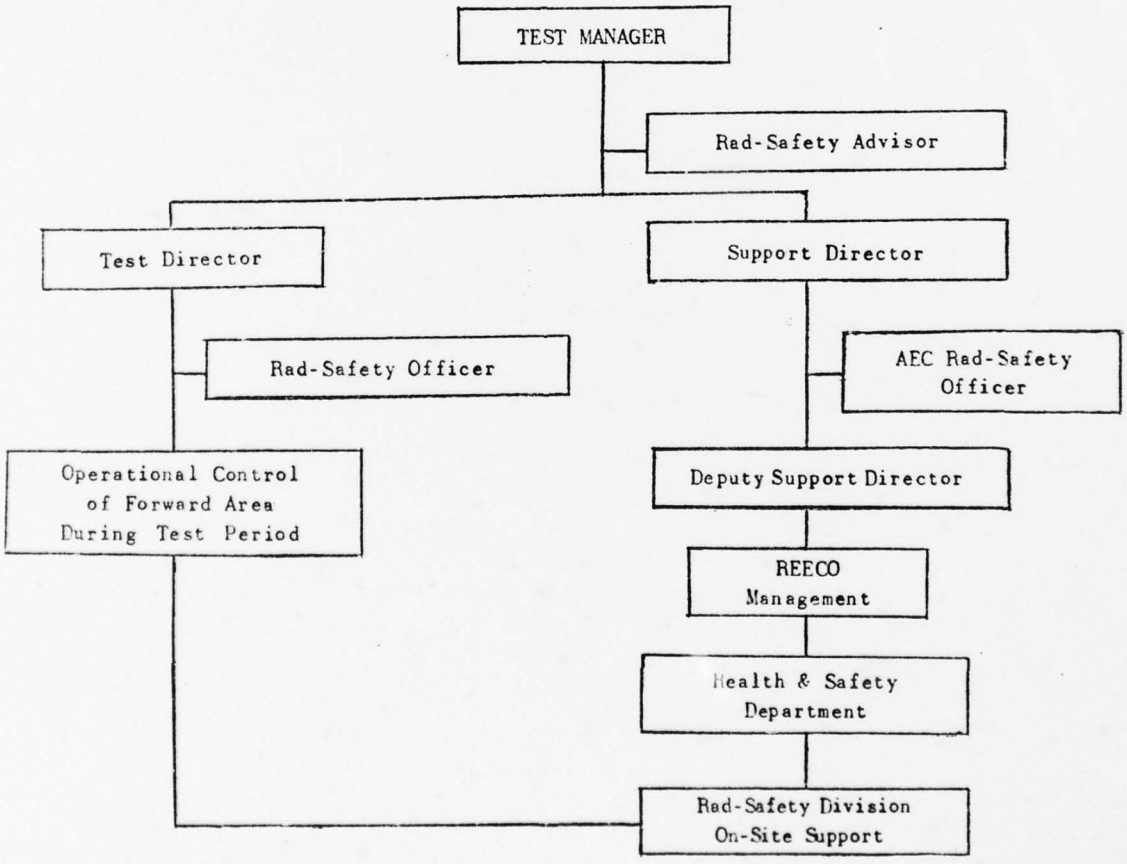

Figure 1.1

The criteria for the on-site rad-safety operation during Operation Plumbbob were established by USAEC Headquarters. The total cumulative exposures authorized for test personnel were as follows:

Gamma, a maximum of 3.0 roentgens (r) for any 13 consecutive week period with a maximum of 5.0 r total within a period of one calendar year.

Alpha, 10,000 units per any consecutive 13-week period, computed by multiplying the average air concentration, excluding natural background, in the area of exposure in d/m per M^3 by the hours of exposure, when no protective equipment is worn.

1.2 The Radiological Safety Division, a part of the REECO Health and Safety Department, was organized into seven branches to facilitate accomplishing specialized fields of work during the period of increased activity. Each branch was supervised by a leader. Two supervisors directed the Branch Leaders in the general categories of field and support branches. The Rad-Safe Superintendent was responsible for the Division operation.

At the peak of the Plumbbob operation, the Rad-Safe Division consisted of 72 civilian employees augmented by 38 military personnel from the U. S. Army First Radiological Safety Support Unit, Fort McClellan, Alabama. The Commander, Task Unit 6, Task Group 7.1, Joint Task Force SEVEN, Los Alamos, New Mexico, with the permission of the Test Manager, furnished the military personnel for on-the-job training.

Figures 1.2 and 1.3 show the Rad-Safe Division's organizational structure and manpower fluctuations during Operation Plumbbob.

1.3 The assignment of responsibilities for each branch of the Rad-Safe Division during Operation Plumbbob was as follows:

1.3.1 The Training Branch was responsible for indoctrinating Nevada Test Site personnel in Rad-Safe procedure, training Rad-Safe personnel and others associated with Rad-Safe functions, providing training material and literature, and briefing official visitors. A maximum of four personnel were assigned to this branch.

1.3.2 The General Monitoring Branch was responsible for performing radiological surveys, maintaining check stations, posting roads and areas to show the radiological status, transmitting data to the Plotting and Briefing Branch, obtaining information pertinent to the radiological status of all working areas at the Nevada Test Site, and providing monitoring assistance when required. A maximum of 38 personnel were assigned to this branch.

1.3.3 The Plotting and Briefing Branch was responsible for controlling the Rad-Safe radio network, compiling radiological data, preparing radiological status maps, issuing access permits, and briefing personnel prior to entry into contaminated areas. A maximum of 12 men were assigned to this branch.

1.3.4 The Decontamination Branch was responsible for operating facilities at CP-2 (Rad-Safe Building) for decontamination of personnel, vehicles and equipment; for operating mobile field decontamination equipment; maintaining a storage area for

contaminated material; and monitoring services as required to check decontamination operations. A maximum of 10 personnel were assigned to this branch.

1.3.5 The Personnel Dosimetry Branch was responsible for providing facilities for issuing and receiving dosimetry devices, processing and evaluating dosimetry devices, recording derived individual exposures, and reporting summations of individual exposures. A maximum of 17 men were assigned to this branch.

1.3.6 The Special Assignments Branch was responsible for investigating unusual radiological safety problems, collecting routine and special samples, performing laboratory analysis of all Rad-Safe samples, controlling radioactive materials at Nevada Test Site, excepting Source and Special Nuclear Material (S.S.N.), maintaining an emergency monitoring team capability, and performing routine surveillance of "clean" living and work areas to detect possible contamination. A maximum of 8 men were assigned to this branch.

1.3.7. The Logistics Branch was responsible for providing supplies and initiating work requests necessary for the Rad-Safe program, operating contaminated clothing laundry facilities, and providing clerical assistance for the Rad-Safe Division. A maximum of 17 personnel were assigned to this branch.

RAD-SAFE DIVISION
ORGANIZATION CHART

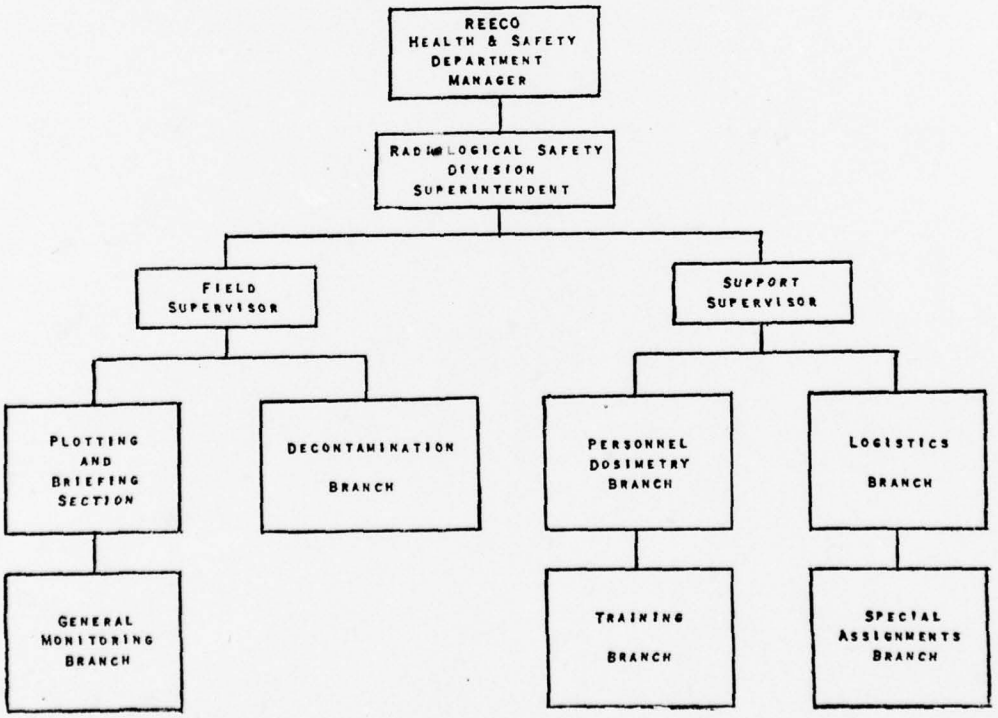

Figure 1.2

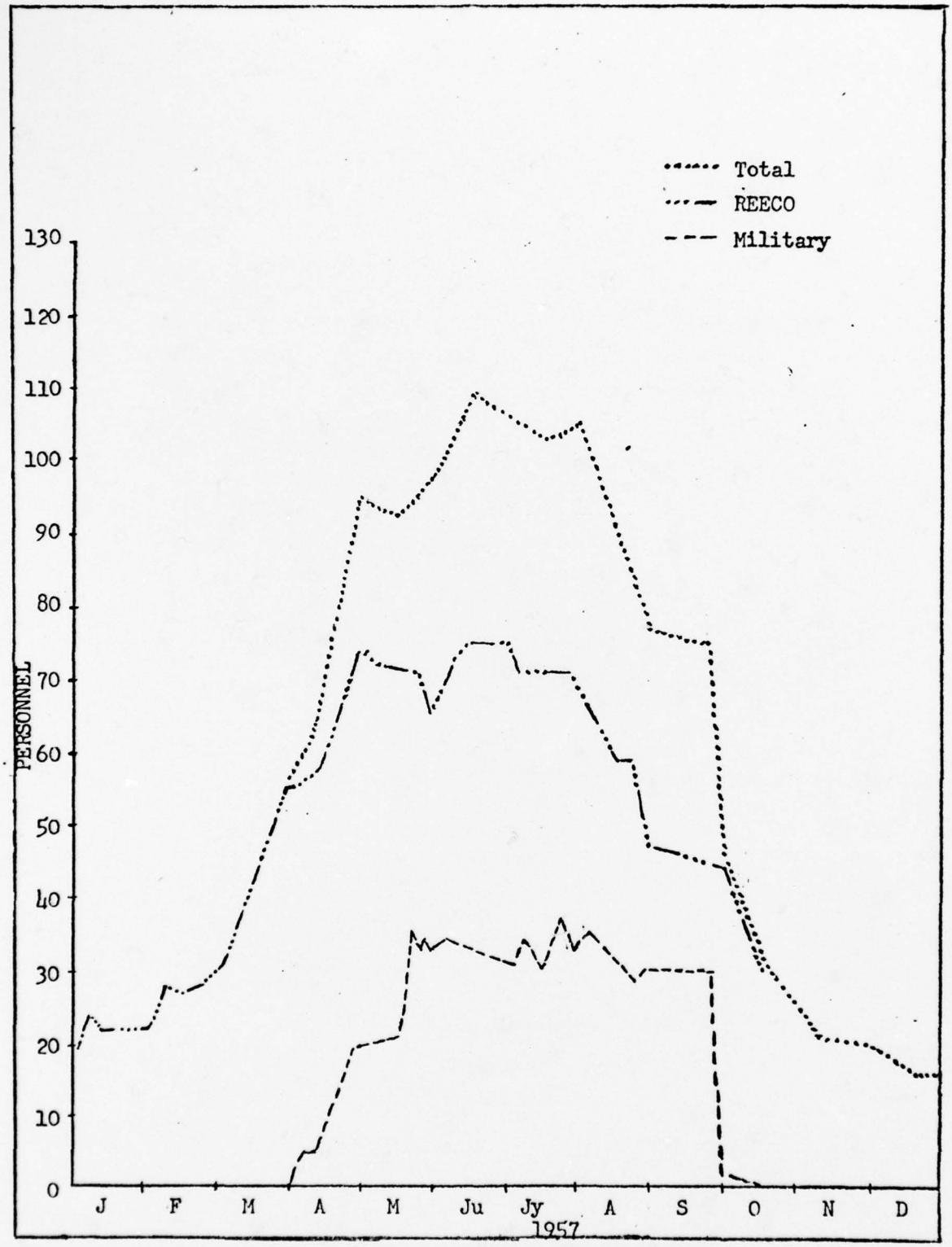

Figure 1.3 Rad-Safe Manpower Fluctuation

CHAPTER II

Procedures

2.1 The procedures employed by the REECO Rad-Safe Division to implement the radiological safety program at Nevada Test Site during Operation Plumbbob are discussed in the following sections. Detailed Rad-Safe procedures for the Nevada Test Site are contained in the Standard Operating Procedures, (SOP), for the REECO Rad-Safe Division. This SOP is available to interested agencies upon request.

2.2 General Procedures and Activities

Information signs were posted throughout NTS to direct personnel to film badge issue points and other Rad-Safe facilities. Warning signs were posted at contaminated area check points and at the 10 mr/hr and 100 mr/hr dose rate lines on the main access roads to contaminated areas. Plastic overlay maps showing current radiological situations were maintained at the Control Point, (CP-1), CP-2, and the Programmatic Building at the Control Point; and Building 123, Building 101, and Quonset No. 5 in Mercury.

A sign indicating contaminated areas was located on the Mercury Highway opposite CP-2 to direct personnel to stop at the CP-2 if they were scheduled to work in any of the posted areas. Daily bulletins on contaminated areas, Rad-Safe controls and Rad-Safe facilities were distributed to operating and planning personnel, and were posted throughout NTS.

Rad-Safe monitors routinely surveyed all contaminated areas. Monitors were assigned to highly contaminated areas to warn, advise and assist personnel who entered the areas. Fallout trays and air samples were placed, collected and analyzed to determine air concentration in test areas and populated "clean" areas. Special monitoring was performed to detect possible spread of contamination to "clean" work and living areas.

Radioactive sources were controlled through source registry and periodic location inspection. Radioactive material to be shipped off-site was inspected, packaged and monitored as necessary for compliance with AEC and ICC regulations.

All personnel within NTS, exclusive of Camp Desert Rock personnel and certain escorted official observers, were issued film badges. These badges were attached to the security badge. Film badges were exchanged monthly and after exit from any contaminated area. An individual metal charge-a-plate was issued to each person to facilitate issuing film badges and Rad-Safe equipment. Guards of Federal Services, Incorporated, (FSI), assisted in this program by checking personnel entering the Main Gate at NTS for possession of a current film badge. Film badges were identified by colored tapes across the top of the film pocket. Contrasting colors were used for successive months. Film badge exchange stations were located in Building 111 outside the Main Gate, in the Mercury office of the REECO Health and Safety Department, and in CP-2. During film badge exchange periods, at the end of each month, additional stations were established at the Mercury cafeterias and the Recreation Building. The charge-a-plate information was stamped on IBM cards previously numbered to correspond with the issued film badge numbers.

Upon processing and evaluation of each film badge, the exposure was entered on the matching card and the card sent to the REECO Machine Accounting Division in Las

Vegas. Master cards showing accumulated exposures for each person were prepared. The IBM system was used to tabulate individual exposure reports for distribution to concerned agencies. Dosage reports compiled routinely were as follows: Daily report on individuals turning in a film badge for the previous day; over 2 r report when required; and a weekly and monthly tabulation on accumulated quarterly and yearly exposures.

A three-day basic training course was given to all Rad-Safe Division employees and to previously untrained project monitors. The NTS Basic Monitor Training Manual was used as a course text. The course subject material was basic mathematics, fundamental physics, radioactivity, biological effects of radiation, radiation detection instruments, radiation protection, decontamination, personnel dosimetry, test effects, sampling and analysis techniques, and a field trip.

Re-orientation lectures of two to four hours duration, including tours of the CP-2 and facilities, were given to previously trained monitors, Federal Civil Defense Administration, (FCDA), and Civil Effects Test Group, (CETG), participants, U. S. and foreign military personnel, and Camp Desert Rock personnel. Indoctrination lectures and literature were given to all new employees in conjunction with security lectures. A reference library of radiological safety information was established for Rad-Safe employees and test personnel. Literature was available on a two-week loan basis. A series of articles were published in the NTS newspaper.

2.3 Pre-detonation Procedures and Activities

All shot areas were re-surveyed and re-mapped showing existing roads radiating from the ground zeros in preparation for Operation Plumbbob. Eight radial roads originating at or near ground zero were necessary to determine radiation dose rate contours in each of the test areas. New roads were bladed in those areas where suitable roads were not in existence. The 5000-foot Nevada Grid Coordinates System was used for locating survey stakes in the test area prior to the operation. These were used as reference points to prepare Rad-Safe maps of the entire test area. Numbered Rad-Safe stakes were then placed on the radial roads at 0.5 mile intervals from each ground zero using vehicle odometer readings to the nearest 0.05 mile.

Plotting facilities were established in the CP-1 and the CP-2 for simultaneous development of radiation dose rate contours following each detonation.

Access permits were prepared in advance for recovery parties who would enter the test area after a detonation. Rad-Safe monitors were assigned to accompany each party not having a Test Director approved project monitor in the party.

Rad-Safe initial ground survey teams were briefed by the Monitoring Branch Leader on the expected fallout pattern prior to each detonation. Four teams of two men each were responsible for obtaining the information necessary to plot the dose rate contours.

Training Branch personnel participated in briefings for official observer areas prior to the detonations.

2.4 Post-detonation Procedures and Activities

Rad-Safe Division initial ground survey teams entered the test areas immediately

after each detonation to determine location of dose rate lines and radiation levels at specific locations. Teams used radio-equipped vehicles and helicopters. The distances to 10, 100, and 1000 mr/hr lines from reference stakes (odometer readings) were transmitted by radio to CP-1 and CP-2 where the dose rate contours were plotted on plastic overlay maps. Special readings above 1000 mr/hr or at specific locations were obtained as requested. A roving team monitored radio transmissions and maintained contact with each survey team. In the event of vehicle failure, the roving team was available to transport survey personnel from contaminated areas.

Contaminated area access control stations were established on the main access roads to the test areas outside the 10 mr/hr lines. The main check stations were mobile house trailers equipped with radios, radiation detection instruments and other Rad-Safe equipment. Signs were posted on frequently used back roads directing personnel to enter and exit through check stations. Persons entering these areas were required to present access permits issued by the Rad-Safe Division. "Contaminated Material" stickers were affixed to all vehicles entering the areas and the stickers were removed only after monitoring checks indicated that vehicles were not contaminated. All material removed from contaminated areas was monitored, and, if found contaminated, stickers were left on vehicles or affixed to other equipment, and personnel were requested to take the equipment to the CP-2 area for decontamination. Personnel returning from contaminated areas routinely passed through monitoring and decontamination facilities in the CP-2.

Access permits were issued at the CP-2 to all persons who entered Rad-Safe controlled contaminated areas. Persons entering full Radex (radiation exclusion - above 100 mr/hr gamma) areas were issued complete anti-contamination clothing, respirators, and pocket dosimeters. Persons entering limited Radex areas (above 10 mr/hr but less than 100 mr/hr) were issued anti-contamination clothing and equipment as deemed necessary by Rad-Safe briefing personnel. Mid-way through the operation, due to the extensive contamination of the forward area, continuing limited Radex access permit cards were issued to workers when approved by each organization's Rad-Safe representative. These workers required frequent entry into contaminated areas less than 100 mr/hr. The cards were retained by each individual provided he exchanged his film badge at least once each week or after any possible significant exposure.

After issuance of access permits, personnel were briefed on radiological conditions in the areas they intended to visit or work, and advised on the anti-contamination clothing and equipment required.

Post-shot surveillance of contaminated areas presented unusual problems. The clearing of a party into a work area by a specified route did not always assure safety of the party. A lack of respect for radiation, coupled with curiosity, would often lead individuals into undesirable situations. Consequently, it was necessary to assign to each area a roving monitor who vigilantly observed the activities of all persons in his area. The roving monitors also assured that radiation warning and dose rate signs were properly posted. Since the dose rate lines continually receded or were expanded by new contamination, the stake-type signs were replaced by sawhorse-type signs to facilitate moving them each day.

Rad-Safe monitors conducted re-surveys of shot areas at H / 6 hours and D / 1, D / 2, D / 3, D / 5, and D / 7 days after each detonation, and periodically

thereafter. Current radiological situations were plotted on plastic overlay maps at the six NTS locations.

Anti-contamination clothing and equipment were issued to personnel at the CP-2. Charge-a-plates were used to receipt for equipment, and clothing was pre-packaged to speed up issue at the supply counter. Temporary facilities were maintained at Area 13 and at Frenchman Flat while those areas were under Rad-Safe control. This enabled test personnel to enter the areas without traveling first to CP-2. For the convenience of test personnel, anti-contamination clothing and equipment were delivered to remote test areas not covered by field facilities

Contaminated clothing was washed at the CP-2 laundry facilities. Clothing highly contaminated with alpha emitting material was sealed in plastic bags and buried at the contaminated waste burial area. Vehicles and equipment were decontaminated at the facilities east of the CP-2. Vacuum cleaners, high pressure water and detergent mixtures were used to reduce contamination to permissible levels. Vehicles and equipment which could not be successfully decontaminated were placed in a "hot park" adjacent to the facilities until normal decay had reduced contamination to permissible levels. The activities of those branches which were not concerned directly with individual shots are recorded in the shot reports.

CHAPTER III

Shot Reports

A summary of the Rad-Safe Division activities for each shot period is included in this section. Shot reports covered the period of time from D-1 day of a particular shot to D-1 day of the next succeeding shot. However, exceptions are the Project 57 report and reports for shots which occurred on successive days. Safety experiments, which involved a relatively small amount of support, are included in the shot reports of larger shots. Tabulated summary data for each Branch are listed in Section 3.32 of this chapter.

3.1 Nevada Test Site Maps

The map on the succeeding page (Figure No. 3.1.1) shows the test area locations in Yucca Flat. This map shows the 10, 100, and 1000 mr/hr lines, plus ground zero and special readings where appropriate, as measured on December 12, 1957, two months after the close of the Plumbbob Operation. The lettered tabs indicate each area with names and dates of Plumbbob and subsequent detonations. Numbered grid markings are the 5000-foot Nevada Grid Coordinates. Test areas not shown are Area 11 which lies east of Yucca Lake, Area 12 which lies a few miles northwest of Area 2, and Area 13 which lies several miles northeast of Area 2-c.

In addition, a special map of the Frenchman Flat area was prepared by Rad-Safe personnel for the Priscilla shot. This map is included in the Priscilla shot report (Section 3.7), and individual maps of the test areas involved are included in reports for each shot.

3.2 Project 57 (April 24 through October 22, 1957)

Project 57 was the first safety experiment of the Plumbbob Operation. A subnominal non-nuclear device sponsored by Sandia Corporation was detonated in Area 13 at 0627 hours on April 24. The purpose was to spread alpha emitting material in and about the ground zero area to create conditions for conducting studies in biological effects and alpha decontamination procedures.

Rad-Safe participation in this project included direct operational support to Sandia Corporation before and after the detonation, as well as normal Rad-Safe support to all test personnel until the initial program ended in October 1957.

3.2.1 Facilities and Equipment

Decontamination Building:

Prior to D-day, a temporary Personnel Decontamination Building was erected beside the access road into the Project 57 area. Its basic facilities duplicated those of CP-2. Adequate supplies of radiation detection instruments, protective clothing and equipment were stocked. The building contained an issue room, shower stalls, and a dressing room with benches and clothes hangers (Figure No. 3.2.1).

Three-strand barbed wire fences were installed from the Decontamination Building to a distance of several hundred feet on each side. All personnel entering or leaving the area were required to pass through the building.

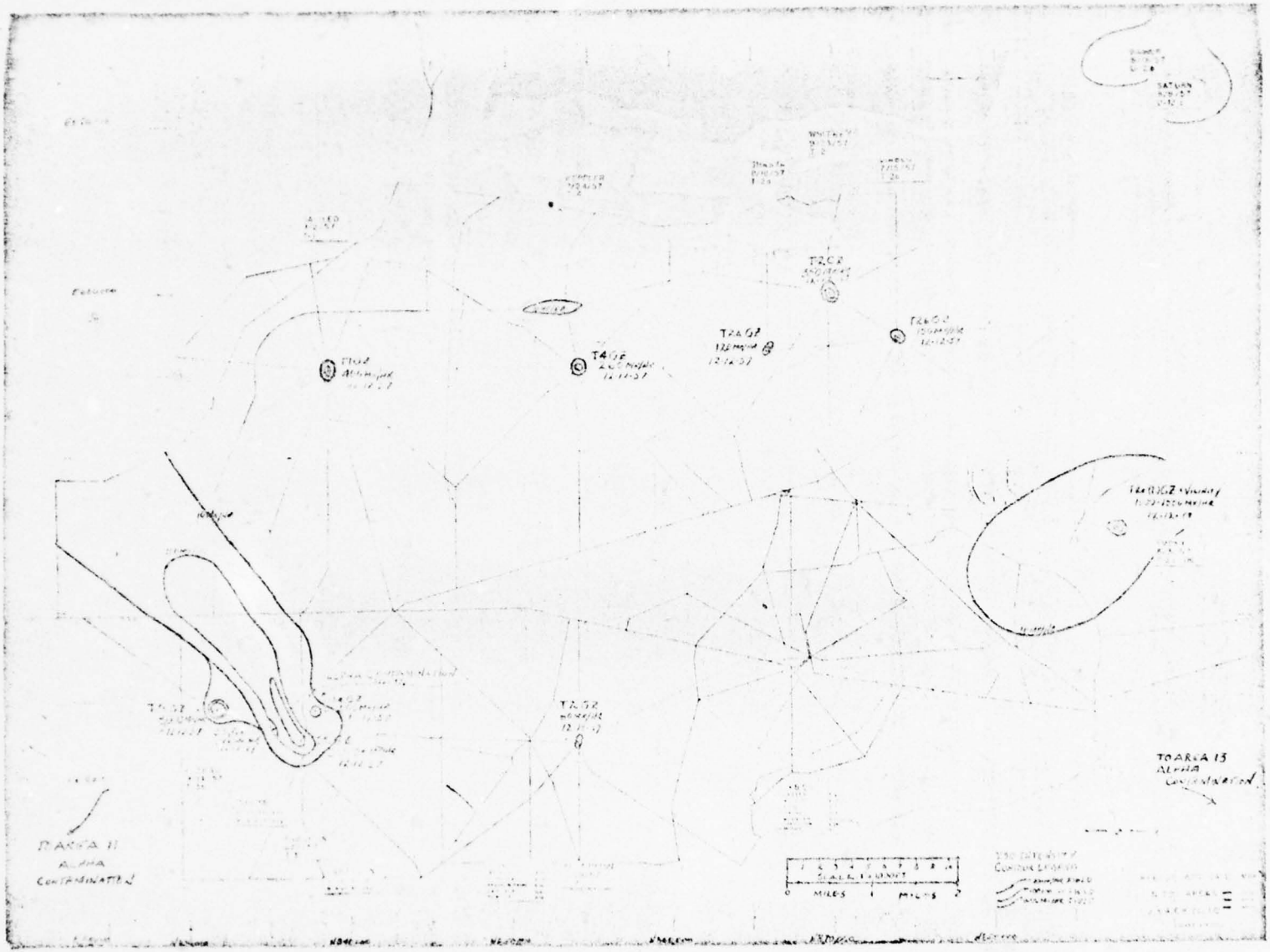

Figure 3.1.1 Yucca Flat Test Area Locations Showing 10, 100, and 1000 mr/hr lines and other special readings as measured on December 12, 1957.

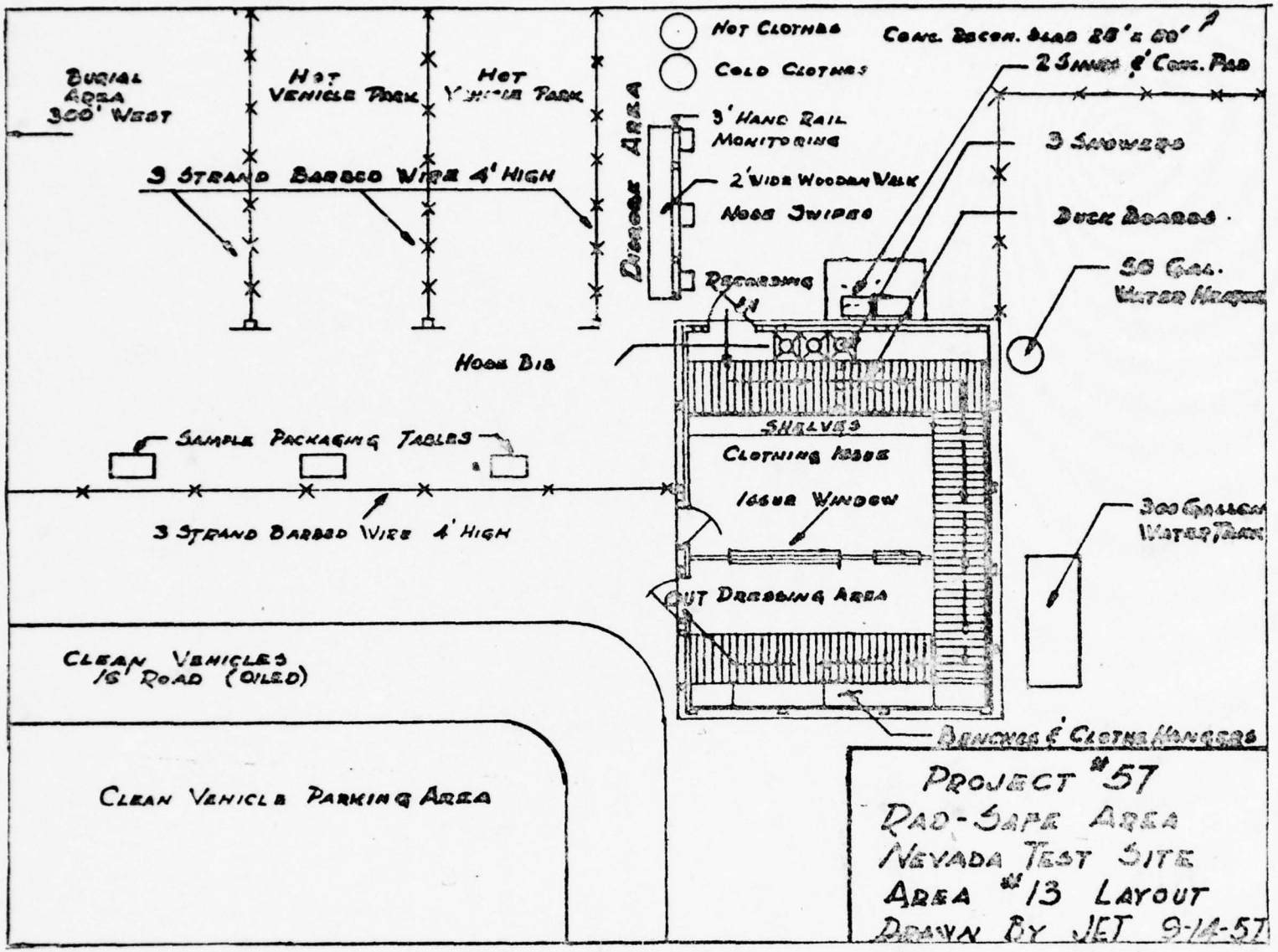

Figure 3.2.1 Project 57 Personnel Decontamination Building

A two-foot wide wooden approach walk was constructed, covered with Kraft paper, and placed at the north entrance to the Decontamination Building. Containers were provided for the disposal of protective clothing.

Parking lots for contaminated vehicles were established inside the area northwest of the building. A parking space for "clean" vehicles was available south of the building.

West of the building, on the contaminated side of the barbed wire fence, three tables were installed for packaging fallout trays, soil samples, etc., for shipment off-site.

Decontamination Equipment:

A 350 gallon hot water supply was installed to provide hot water for the Personnel Decontamination facility.

Vehicles:

During placement of fallout trays in the test areas prior to the detonation, it became apparent that pickup trucks were not practicable transportation due to the extreme roughness of the terrain. Accordingly, radio-equipped power wagons and jeeps were utilized.

Monitoring Instruments and Sampling Equipment:

Area surveys were performed with the following portable instruments:

Beckman MX-5; AN/PDR 34; AN/PDR 39; Eberline PAC I-A;
Nuclear Chicago Model 2111 (Pee Wee).

Sampling equipment consisted of air samplers, impactors and fallout trays.

Magnetic Tray Handles:

The problem of cross-contamination and contamination of personnel who collected the steel fallout trays was solved by using long-handled magnetic pickup devices actuated by six-volt storage batteries (Figure No. 3.2.2).

3.2.2 Pre-Detonation Activities

Fallout Trays:

A major support function of the Rad-Safe Division was the initial placement of trays coated with fresh adhesive, and the replacement of aged trays to provide maximum particle collection efficiency. A total of approximately 15,000 trays were sprayed and set out. Trays were in place at about 80% of the grid intersection locations at detonation time.

The fallout trays were unflanged nine-inch squares of sheet steel coated with adhesive resin-toluene in a 35-65 percent mixture.

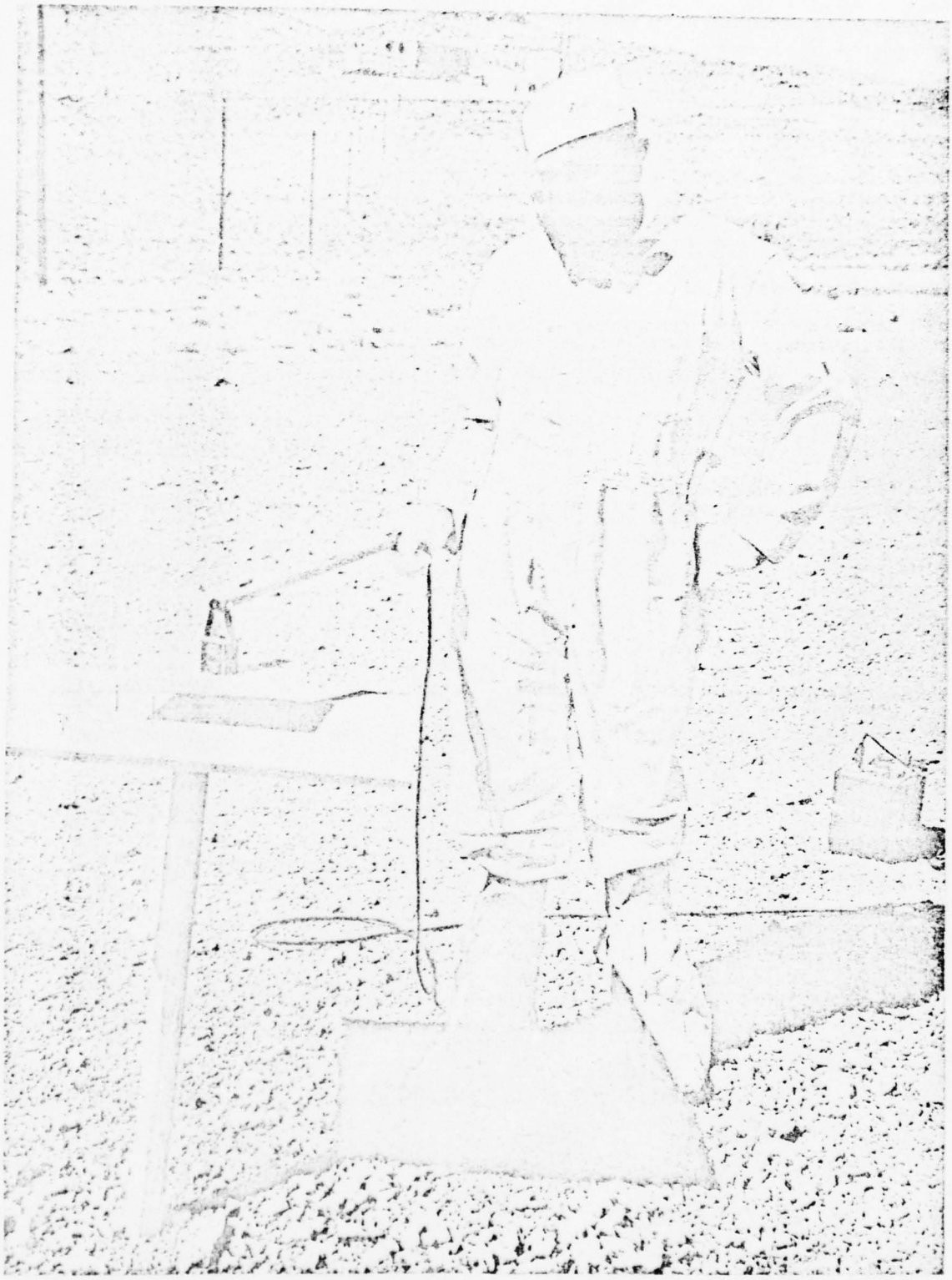

Figure 3.2.2 Long-Handled Magntic Pick-up Device

Tray Placement:

The area covered by the tray placement teams measured approximately 8 by 13 miles. Trays were placed and recovered during a period of 22 days from D-20 to D / 2. A 9-1/2" x 12" grid map showing all the grid stakes and roads in Area 13 was used. (Figure No. 3.2.3).

The area covered by this map was divided into four areas or zones, which were designated Zones A, B, C, and D. A fallout tray stake and platform was established at each intersection of grid lines in all four zones. In Zone A (ground zero zone), the tray platforms were installed at 25-foot intervals; in Zone B, at 250-foot intervals; in Zone C, at 500-foot intervals; and in Zone D, at 1000-foot intervals.

Teams of two men each were utilized in the placement and replacement of the trays. Because of the extremely dusty conditions and shot delays, it was necessary to spray and replace a large number of trays several times prior to detonation. Replacement of old trays with freshly sprayed trays in Areas C and D continued over a period of two weeks prior to D-day, with an average 50 percent replacement being necessary each day.

Gusts of wind were constantly blowing a large number of trays from their platforms. Light finishing nails driven into the plywood platforms aligned and held the trays in place and prevented further losses. (Figure No. 3.2.4).

Air Samples:

Comprehensive pre and post-shot air sampling of the Project 57 area was made at the request of Sandia Corporation.

Assistance was given to Sandia Corporation in the placement and setting of timers and placement of batteries at 46 impactor stations.

3.2.3 Post-Detonation Activities

Tray Recovery:

Post-detonation collection of fallout trays was begun at H / 2 hours. The fallout tray collection procedure consisted of picking up a clean tray with the magnetic handle and placing it over the contaminated tray, then picking up and placing this "sandwich" in a container and covering it with a cardboard separator.

Collection of fallout trays in Zones A and B was accomplished by Sandia Corporation personnel.

Rad-Safe Division personnel collected Zone C trays immediately after the detonation. Zone D tray collection was completed by the end of D / 1. However, only those Zone D trays which were in the projected fallout path were collected.

The percentage of desired trays recovered was 100 percent in Zone A, 90 percent in Zones B and C, and 80 percent in Zone D. Incomplete recovery was also effected by loss of trays due to high winds.

All fallout trays recovered between April 24 and April 26 were packaged for shipment to Sandia Corporation.

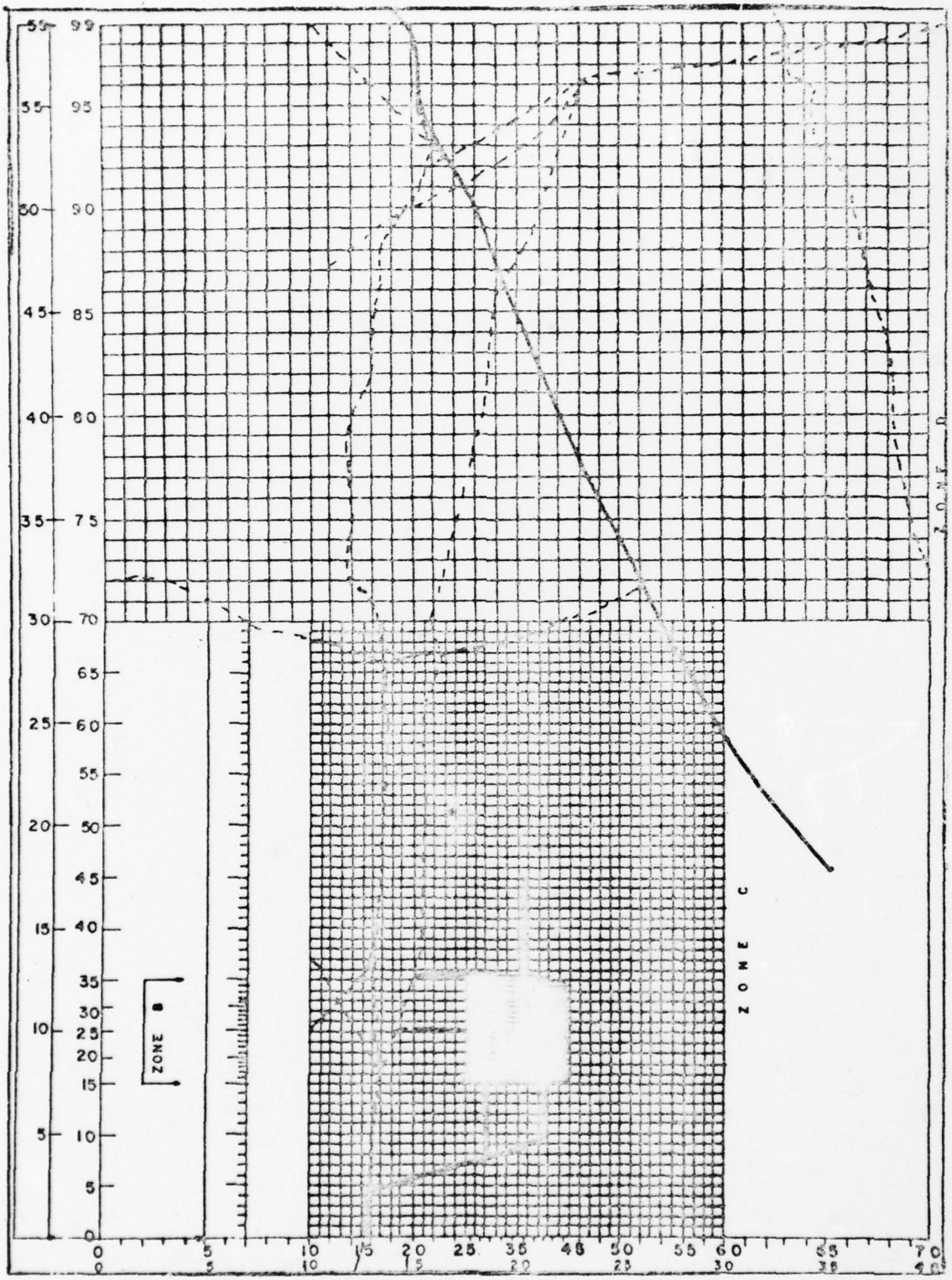

Figure 3.2.3 Project 57 Grid Map

Figure 3.2.4 Tray Alignment

Radiological Safety Control:

Immediately after the detonation, a survey of ground zero was made using Beckman MX-5 and AN/PDR 34 instruments to detect beta activity and AN/PDR 39 instruments to measure gamma dose rate.

Full anti-contamination clothing was worn in all Project 57 areas with respiratory devices required as follows:

Area Designation	Device
A	Air supplied or full-face mask with dust, fume and mist cannister
B	Full-face mask with the dust, fume and mist cannister
C & D	Ultra-filter respirator

Personnel contamination was maintained as low as possible, and decontamination was performed when levels exceeded 100 c/m/55cm^2 on skin as determined by portable alpha survey instruments.

Respiratory protective devices were considered contaminated when the level of contamination exceeded 100 c/m/55cm^2 as determined by portable alpha survey instruments.

Vehicles and equipment were not removed from the Project 57 area unless contamination levels were such that portable alpha survey instruments indicated less than 500 c/m/55cm^2 of alpha activity. Higher levels were decontaminated.

Nasal swabs were taken from all persons leaving the contaminated area, and each individual submitted urine samples for analysis.

Decontamination:

Personnel leaving the contaminated area were monitored and their protective clothing removed and deposited in the receptacles provided, one for relatively clean (less than 1000 c/m/55cm^2), and the other for highly contaminated clothing. All persons were monitored with portable alpha survey instruments and nasal swabs were taken. After entering the building and showering, personnel entered the "clean" area and dressed in their personal clothing.

Animals removed from the contaminated area were monitored and, if contaminated, were decontaminated by the use of vacuum cleaners and by washing with soap and water.

All equipment and vehicles exceeding permissible levels of contamination were decontaminated at the Project 57 site before release. Equipment and devices were buried in a location provided for that purpose if decontamination was not successful.

Other Services:

Prior to the Project 57 detonation, it was necessary to clear the area repeatedly of range cattle which were grazing near the several water holes in the test area. Rad-Safe personnel continued to drive the returning cattle from the area after the detonation until the contaminated area ($100/^{\mu g}/_{M^2}$) was fenced with three strand barbed wire on July 2. The maximum number of cattle in the area was estimated at 300-head

Impactors were collected for Sandia Corporation on D-day and recovery of batteries and pumps from impactor stations was completed on D + 2 days.

Air filters, fallout trays, impactor pads, and about 126 soil samples were packaged and shipped to Sandia Corporation. Continuing air samples were taken around the Decontamination Building and in the ground zero area and analyzed in the Rad-Safe Laboratory.

Program 72 recovery parties utilized Scott full-face air-supplied masks and Type H air cylinders supplied by the Rad-Safe Division.

A mobile rest station for persons working in Zones C and D was manned by Rad-Safe personnel. A monitor with first-aid training was a member of the operating crew. Clean clothing, washing and drinking water, soap, towels, nose swipes, etc., were carried. This unit operated through D + 3 days.

Daily radiological surveys were made inside the Decontamination Building and in surrounding "clean" areas utilizing alpha survey instruments, filter paper swipes and air samplers.

Anti-contamination clothing and equipment were issued to personnel entering the area, and the decontamination facilities operated on a continuing basis. Nasal swabs were taken from all personnel leaving the contaminated area and analyzed by the Rad-Safe Division. Urine samples were collected, packaged, and shipped off-site for analysis.

Soil samples and additional fallout trays were routinely collected, packaged and shipped as requested.

3.2.4 Data

Surveys and Sampling:

Pre-shot surveys indicated no significant alpha, beta or gamma activity in the test area.

An initial post-detonation survey of the ground zero area indicated extensive alpha contamination but no significant beta-gamma activity.

Results of air samples obtained April 30 at locations 500 and 1000 feet from ground zero with a 15 knot wind blowing from the southeast were as follows:

Location	Long-Lived Alpha d/m per M^3	
	500 feet	1000 feet
North	498	686
East	200	12.7
South	217	268
West	304	183

Air samples collected on the north side of the Decontamination Building indicated activity of less than 32 d/m per M^3 during the interval from April 24 to April 30.

Daily surveys and swipes inside the Decontamination Building indicated no significant alpha contamination.

Personnel Contamination:

Nasal swabs obtained from 389 participating personnel in the first week following the detonation were negative except for one individual who removed his full-face mask in the vicinity of ground zero. (Subsequent body fluid sampling from this individual indicated no significant internal exposure).

A total of 73 urine samples were obtained from personnel of participating groups and forwarded to their organizations. All groups reported negative results.

Rad-Safe Manpower:

When the Project 57 operation was at the height of its activity, 56 men were used for tray collection, continued surveying, sampling, packaging, and maintenance of the Decontamination Building.

Material and Supplies:

Anti-contamination clothing and equipment issued to 389 persons from April 24 to April 30 included the following items:

Item	Number
Shoe Covers (pairs)	601
Gloves (pairs)	430
Coveralls	389
T-Shirts	389
Shorts	389
Socks (pairs)	389
Caps	389
Shoes (pairs)	152
Full-Face Masks	96

Miscellaneous items issued during this period included nasal swabs, urine sample kits, spare filters, hand cream, masking tape, etc.

From April 30 to October 22, the following supplies were issued at the Decontamination Building:

Item	Number
Nasal Swabs	3250
Drinking Cups	2750
Shoe Covers (pairs)	2748
Coveralls	1900
Cotton Gloves (pairs)	1775
Surgical Caps	1530
Shorts	1334
T-Shirts	1190
Towels	1160

Item	Number
Socks (pairs)	952
Respirators	689
Full-Face Masks	563
Paper Bags	550
Plastic Bags	428
Masking Tape (rolls)	150
Surgical Gloves (pairs)	120
Kimwipes (boxes)	57
Alcohol (pints)	12
Fend-X (tubes)	12

3.3 Boltzmann (May 27 through May 31, 1957)

Boltzmann was a 500-foot tower shot in Area 7. The device was detonated at 0455 hours on May 28, 1957. The mushroom cloud rose to a height of 33,000 feet MSL and moved in a general northwesterly direction. Recovery operations commenced at 0608 hours.

3.3.1 General Monitoring Branch

The aerial survey team (H-21 helicopter) was dispatched at 0510 and proceeded on a predetermined route over Area 7 at a 25-foot altitude. Due to ground haze and dust resulting from the shot, ground points could not be identified. The helicopter returned contaminated after flying through the radioactive cloud. The rotor area measured 200 mr/hr gamma, but the general contamination level was below 1 mr/hr The rotor area decayed to less than 7 mr/hr in two hours. The helicopter was dispatched again at 0700 and completed its readings in Area 7 at 0749. The helicopter then made a run over other test areas to determine dose rates at points of interest.

The ground initial survey teams consisted of the Branch Leader, two senior monitors, and four monitor teams (two monitors per team). The Mercury Highway was surveyed by a team of three additional men. At 0510 the teams departed through the Security Station to the Yucca area. The north Mercury Highway survey team encountered contamination of 10 mr/hr and 100 mr/hr at Nevada Grid Coordinates approximately N 860.800, E 681.400. The patrol turned back and attempted to bypass the contamination by detouring over the road leading north from Area 2 access road, but the same contamination levels were again encountered at approximately N 869.500, E 672.550. On advice through Rad-Safe radio net control, the patrol returned to the CP-2 for further instructions.

The initial ground survey party proceeded to Area 7 and completed its initial survey at 0607 hours (mid-time of survey 0551). After the 10 mr/hr and 100 mr/hr levels were established, some of these monitoring teams proceeded to survey the other test areas. Areas 1, 2, and 4 were found free of contamination, but Areas 9 and 12 were contaminated. Access roads in Areas 9 and 12 were barricaded, and radiation warning signs were posted.

Re-surveys of the shot area were made as follows:

Date	Re-Survey days	Mid-time hours
May 28	H / 7	1319
May 29	D / 1	0648
May 30	D / 1	0913
June 1	D / 3	0550
June 2	D / 4	0538
June 5	D / 7	1352
June 7	D / 9	1254
June 11	D / 13	1316

At 0530 hours on D / 1, a Rad-Safe check station was established at the Buster-Jangle Intersection, (BJY), on the main access road leading into Area 7. This check station was manned continuously until 2300 hours on June 1.

At 0730 hours on D / 1, a Rad-Safe check station was established on the access road 110° northeast of Transformer Sub-Station 52 in Area 2 due to contamination in Areas 9 and 2c.

Check stations periodically dispatched roving monitors to the contaminated areas to check on presence of individuals in those areas.

Monitors diverted Watertown and Area 13 traffic through Station 3-356 to Station 7-356 and over Papoose Lake road because of contamination on the Mercury Highway.

Seven monitors were provided as support for scheduled projects. Standby monitors were utilized to support non-scheduled events. One monitor was dispatched to News Nob and two monitors to Jackass Flats to check those areas. No significant radiation was encountered.

At 0500 hours on D / 1 contaminated areas were marked with 10 mr/hr and 100 mr/hr signs.

3.3.2 Plotting and Briefing Branch

Results of the surveys were plotted for display at various locations (Figures No. 3.3.1 through 3.3.5).

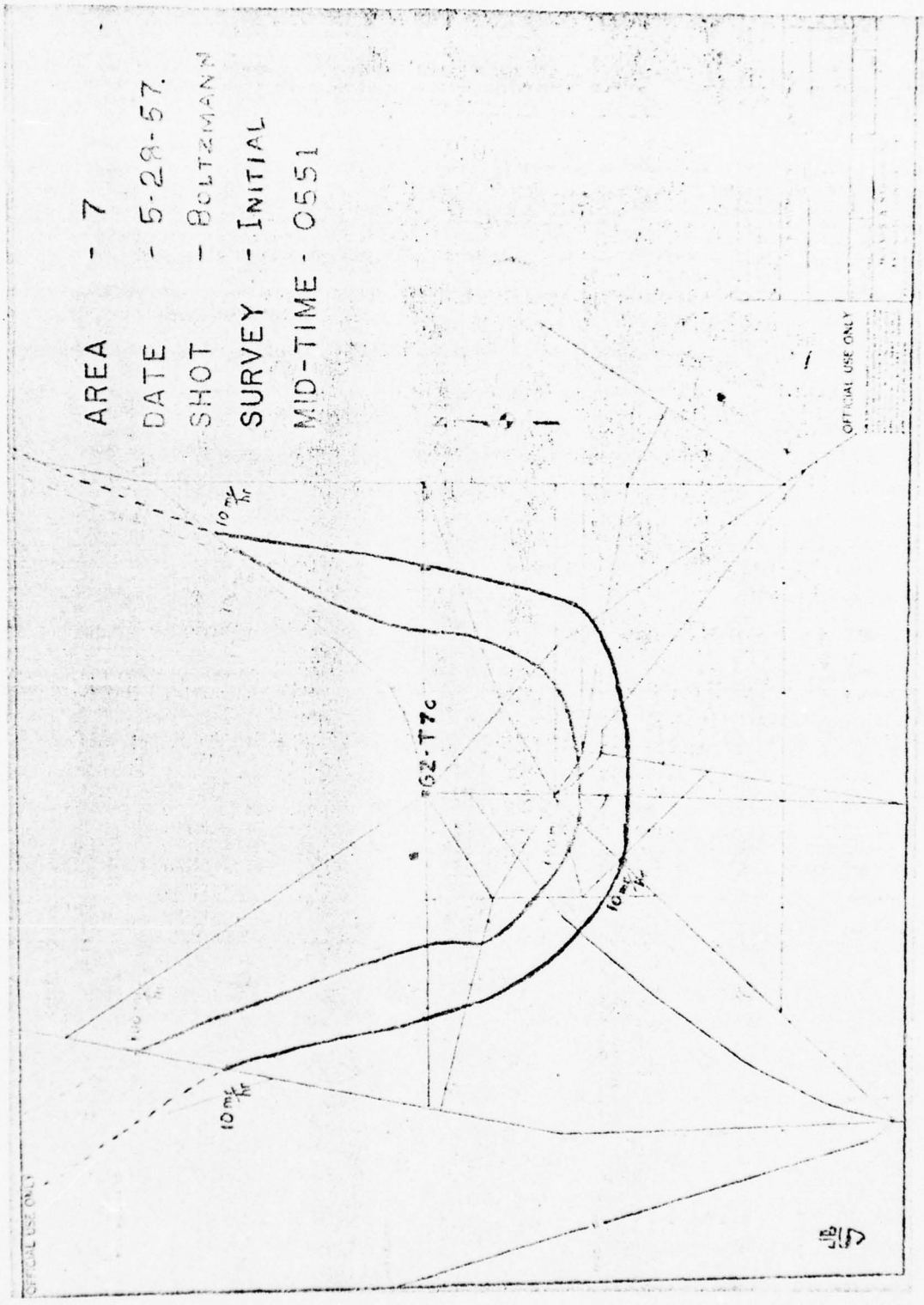

Figure 3.3.1 Boltzmann, Initial

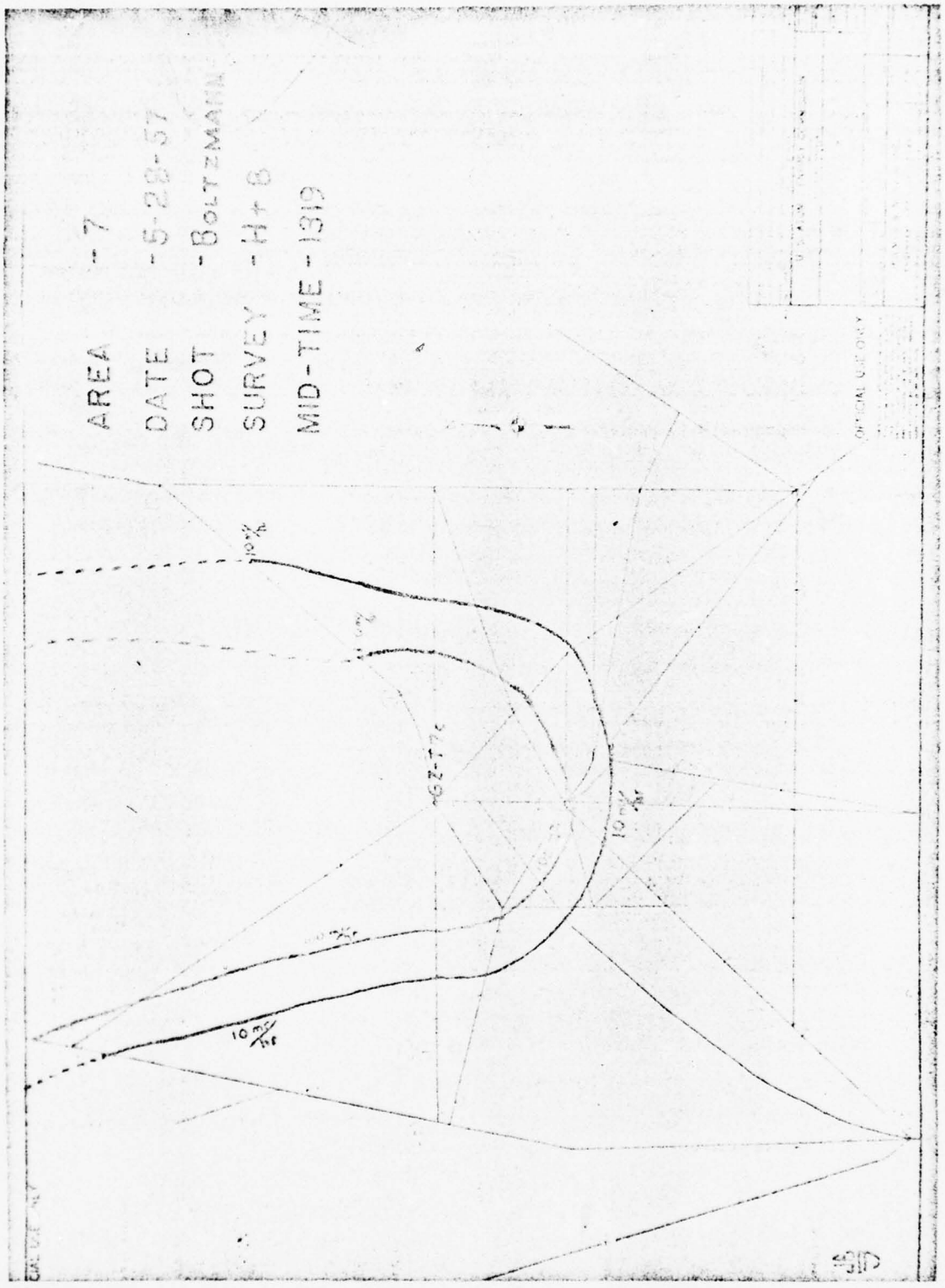

Figure 3.3.2 Boltzmann, H + 8

Figure 3.3.3 Boltzmann, D + 1

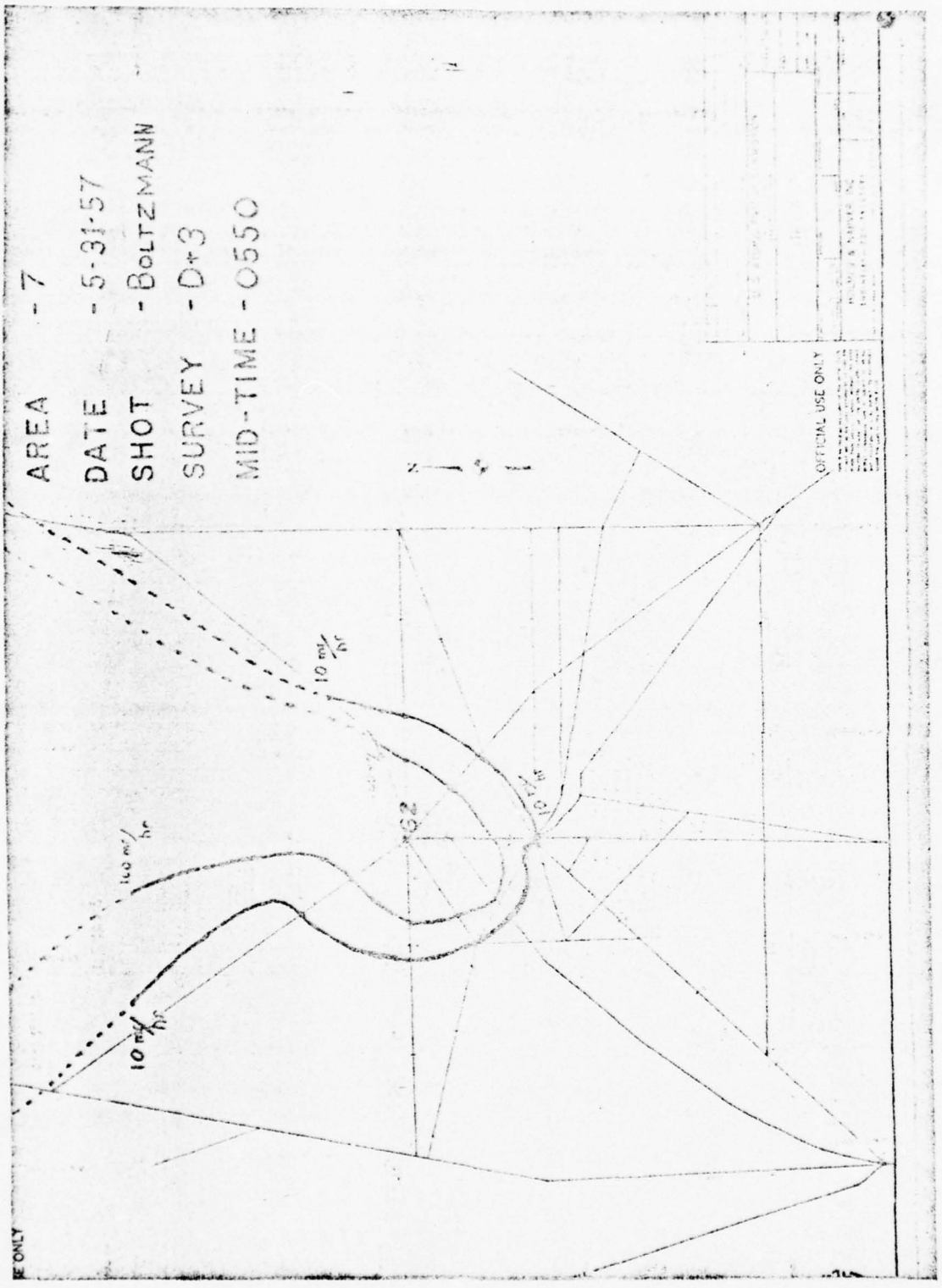

Figure 3.3.4 Boltzmann, D + 3

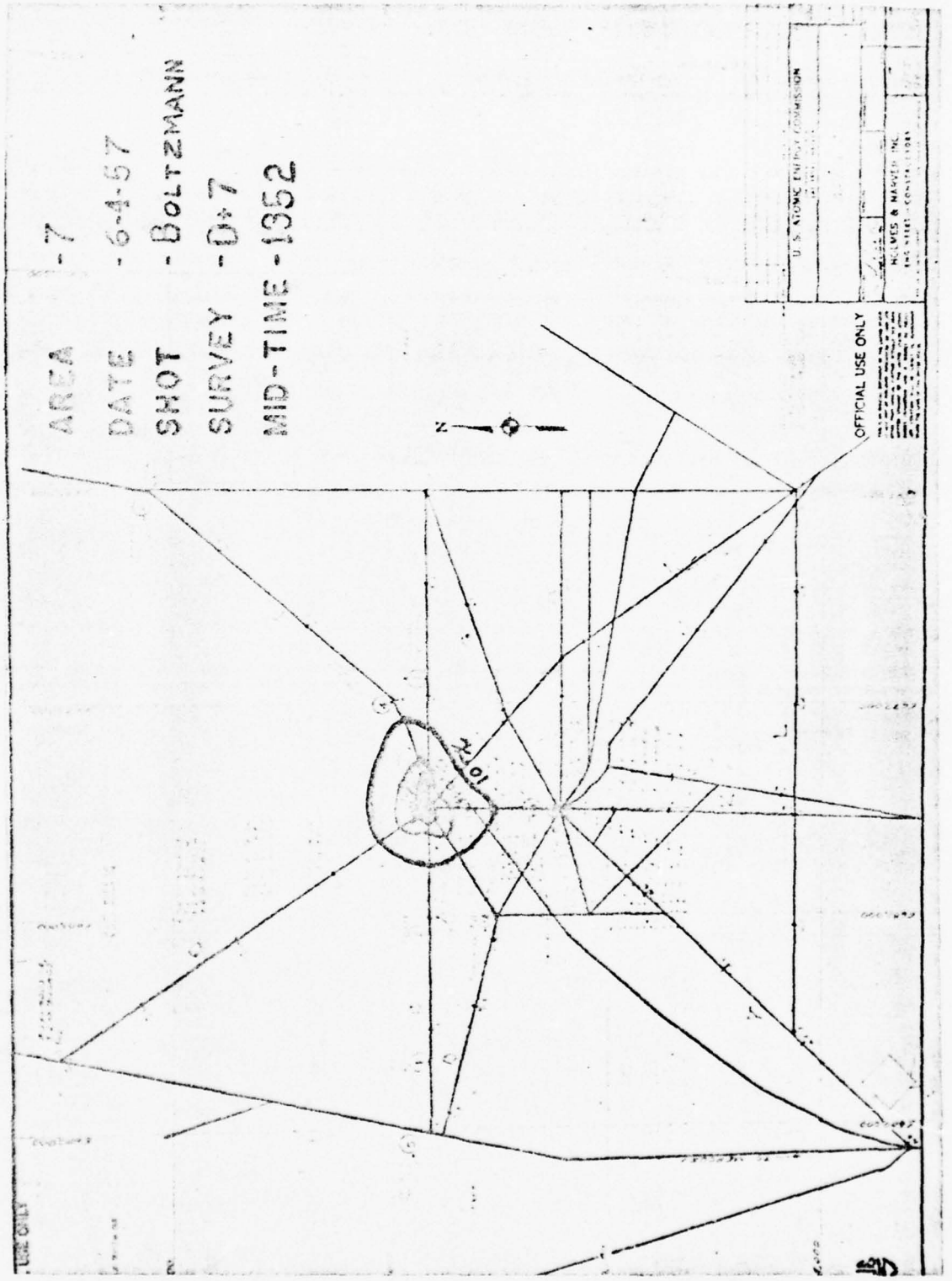

Figure 3.3.5 Boltzmann, D + 7

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
D-day	15	13	52
D / 1	18		57
D / 2	48		170
D / 3	97		308
D / 4	91		275
Totals	269	13	862

3.3.3 Decontamination Branch

The following items were decontaminated at the CP-6:

Equipment	Number
Vehicles	62
Shoes (pairs)	35
Generator	1

3.3.4 Special Assignments Branch

Two boxes of soil samples for Project 3.8, Department of Defense, (DOD), were monitored, processed, and cleared for release from the Test Site.

Air-borne Radioactivity (D-day Averages):

Air Samples:

Location	Long-Lived Alpha d/m per M^3
Warehouse 6	Background
CP-2	Background
Area 2	Background
Gate 385	Background
Area 13	Background
Well 5B	Background

Fallout trays surrounding the shot area at an average distance of five miles indicated no settled alpha activity.

No increase in radioactivity was noted in well and drinking water samples.

The only significant gamma radiation due to fallout in manned on-site areas (exclusive of test areas) was 4 mr/hr at Security Station 395, measured at H / 10 hours.

Radiation surveys in "clean working and living areas" in Mercury and the CP Area were negative.

The following samples were analyzed in the laboratory:

Type	Number
Water Samples	4
Air Samples	128
Surface Swipes	82
Fallout Trays	30
Total	244

3.3.5 Training Branch

Hourly Health and Safety lectures were given at Building 111 each day to new Nevada Test Site personnel.

A Rad-Safe indoctrination lecture was given to a group of 14 North Atlantic Treaty Organization observers in their observer area just prior to the Boltzmann shot. A Rad-Safe initial survey map was developed in the observer area after the shot for the benefit of these observers. They were escorted to the 10 mr/hr line after the detonation and given a briefing on fallout and use of instruments.

A lecture on Rad-Safe anti-contamination clothing procedures was given to 15 FSI personnel at Building 111.

A two-hour Rad-Safe re-orientation lecture and tour was given to eight previously trained DOD monitors and 10 FSI employees at the CP-2.

3.3.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
May 27	837	495
May 28	565	754
May 29	627	758
May 30	567	452
May 31	1043	1777
Totals	3139	4236

Dosimeters:

Date	Issued	Received
May 27	0	0
May 28	183	160
May 29	172	180
May 30	228	220
May 31	218	230
Totals	801	790

3.3.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 657 people as follows:

Item	Number
Coveralls	371
Shoe Covers	658
Other Clothing	897
Miscellaneous Items	549

The laundry processed 1124 pieces of anti-contamination items.

3.4 Franklin (June 1 through June 3, 1957)

Franklin was a device fired from a 300-foot tower in Area 3. The device was detonated at 0455 hours on June 2, 1957. The usual mushroom shape was seen only briefly, as the stem quickly settled back on the Test Site. The top of the mushroom cloud rose to less than 20,000 feet MSL and moved west of due north at a very low speed (approximately 330 degrees at 10 knots). The fireball did not reach the ground, and it was estimated that there was little debris in the cloud. Recovery operations commenced at 0715 hours).

3.4.1 General Monitoring Branch

The aerial survey team was delayed by dust in the shot area. Instead of departing at the scheduled time (H / 15 minutes), the flight left at H / 1.5 hours. The radiation intensity was found to be 10 r/hr at H / 1.7 hours (0637) at an altitude of 25 feet over ground zero.

Ground teams for initial survey of the shot area departed at H / 15 minutes (0510). The team encountered 10 mr/hr at Nevada Grid Coordinates N 832.000. E 679.500. The convoy was halted and one monitor proceeded until 250 mr/hr was encountered at N 834.000, E 679.500 at 0520. Rad-Safe net control was notified by radio and the survey was delayed until H / 30 minutes (0525). At H / 25 minutes (0520) one monitor proceeded to the main access roads to Areas 1 and 3 and encountered no significant radiation. At 0550, 10 mr/hr was encountered at N 846. 050, E 679.740; 100 mr/hr at N 847.100, E 679.750; and 1 r/hr at N 852.900, E 670.620. The initial survey was completed at 0645 hours.

The teams for ground survey of areas other than the shot area (one senior monitor and three monitors) started at H / 15 minutes (0510) and encountered radiation intensities of 400 mr/hr in Area 2, 300 mr/hr in Area 4, and 14 mr/hr at ground zero in Area 9.

At 0600 hours on D-day, the Rad-Safe check station was established at the BJY. It was operated continuously by two-man crews until 2400 hours on D / 1. Thereafter, the station operated as required by area activities through June 4.

Re-surveys were made as scheduled. The mid-time on the H / 6 hour re-survey could not be determined because this re-survey was started before completion of the initial survey and there was some overlapping of data. Other re-surveys were conducted as follows:

Date	Re-survey days	Mid-time hours
June 3	D / 1	0604 hours
June 4	D / 2	1318 hours
June 6	D / 4	1346 hours

A total of eight monitors were provided on shot day.

At 0700 hours on D / 1, contaminated areas were marked with 10 mr/hr and 100 mr/hr signs.

3.4.2 Plotting and Briefing Branch

Survey results were plotted for display at the various locations on the Test Site. (Figures No. 3.4.1 through 3.4.5).

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
D-day	52	24	377
D / 1	113	--	285
D / 2	105	--	421
Totals	270	24	1083

3.4.3 Decontamination Branch

A total of 94 vehicles were decontaminated at the CP-6:

3.4.4 Special Assignments Branch

Ten vehicles were monitored and cleared for release from the Nevada Test Site.

Air-borne Radioactivity (D-day Averages):

Air Samples:

Location	Long-Lived Alpha d/m per M^3
Mercury	Background
Gate 385	Background
CP Area	Background
Area 13	Background

Fallout Trays:

Location	Long-Lived Alpha d/m per ft^2
Mercury	67
CP Area	50
Area 2	84

Location	Long-Lived Alpha d/m per ft^2
Gate 385	32
Area 13	Background
Shot Area (Average)	116

No increase in radioactivity was noted in well and drinking water samples.

The only significant gamma radiation levels due to fallout in populated on-site areas (exclusive of test areas) was a maximum of 10 mr/hr at the CP-2 as measured at H / 2 hours with an MX-5 (shield closed) held three feet above the ground.

Radiation surveys in""clean working and living areas" in Mercury and the CP Area were negative.

The following samples were analyzed in the laboratory:

Type	Number
Air Samples	72
Nasal Swabs	23
Surface Swipes	74
Fallout Trays	40
Total	209

3.4.5 Training Branch

Hourly Health and Safety lectures were given each day at Building 111 to new Nevada Test Site personnel.

A Rad-Safe re-orientation lecture and tour was given to three previously trained DOD monitors at the CP-2.

3.4.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Reported
June 1	420	843
June 2	608	572
June 3	341	436
Totals	1369	1851

Dosimeters:

Date	Issued	Received
June 1	304	290
June 2	407	421
June 3	122	140
Totals	833	851

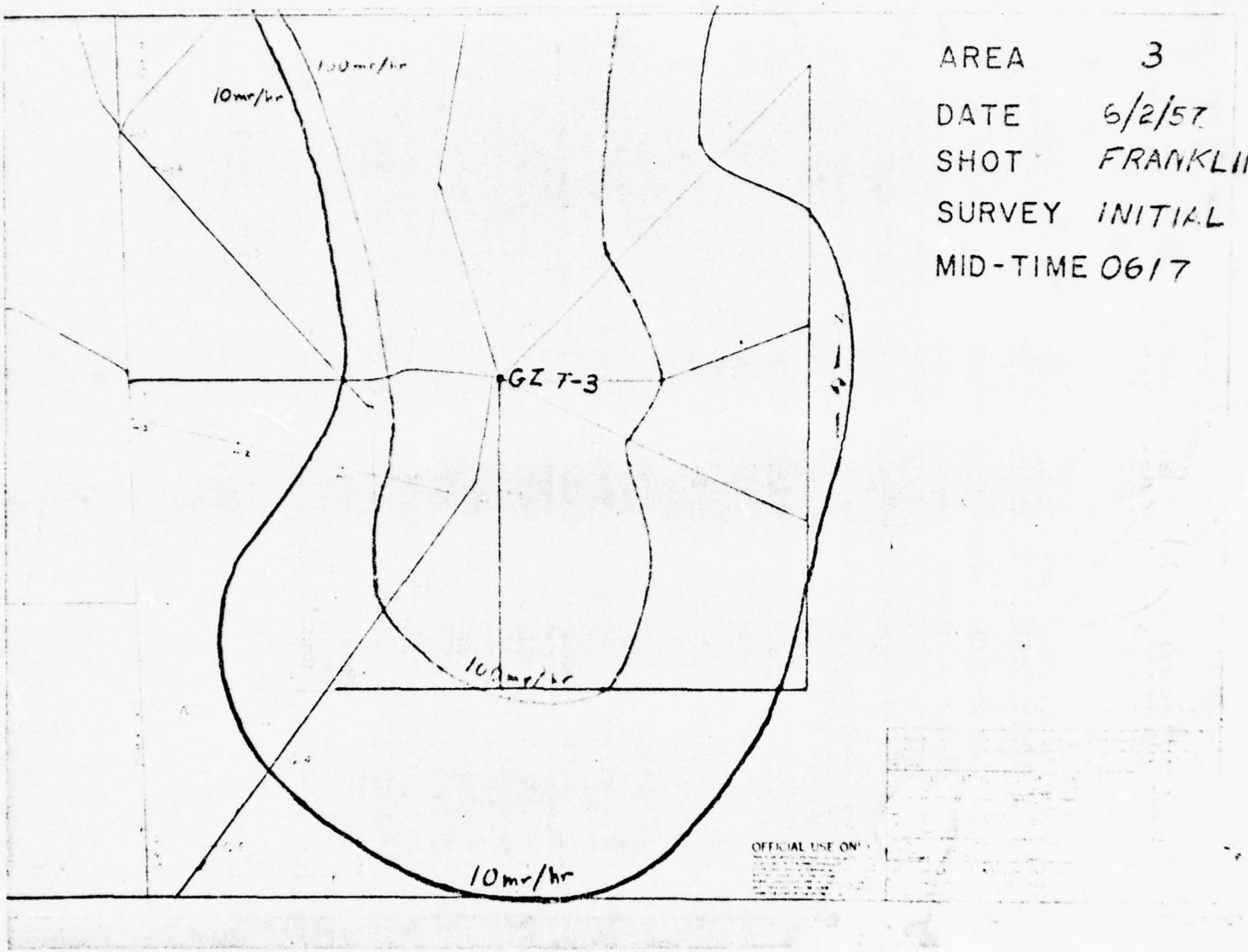

Figure 3.4.1 Franklin, Initial

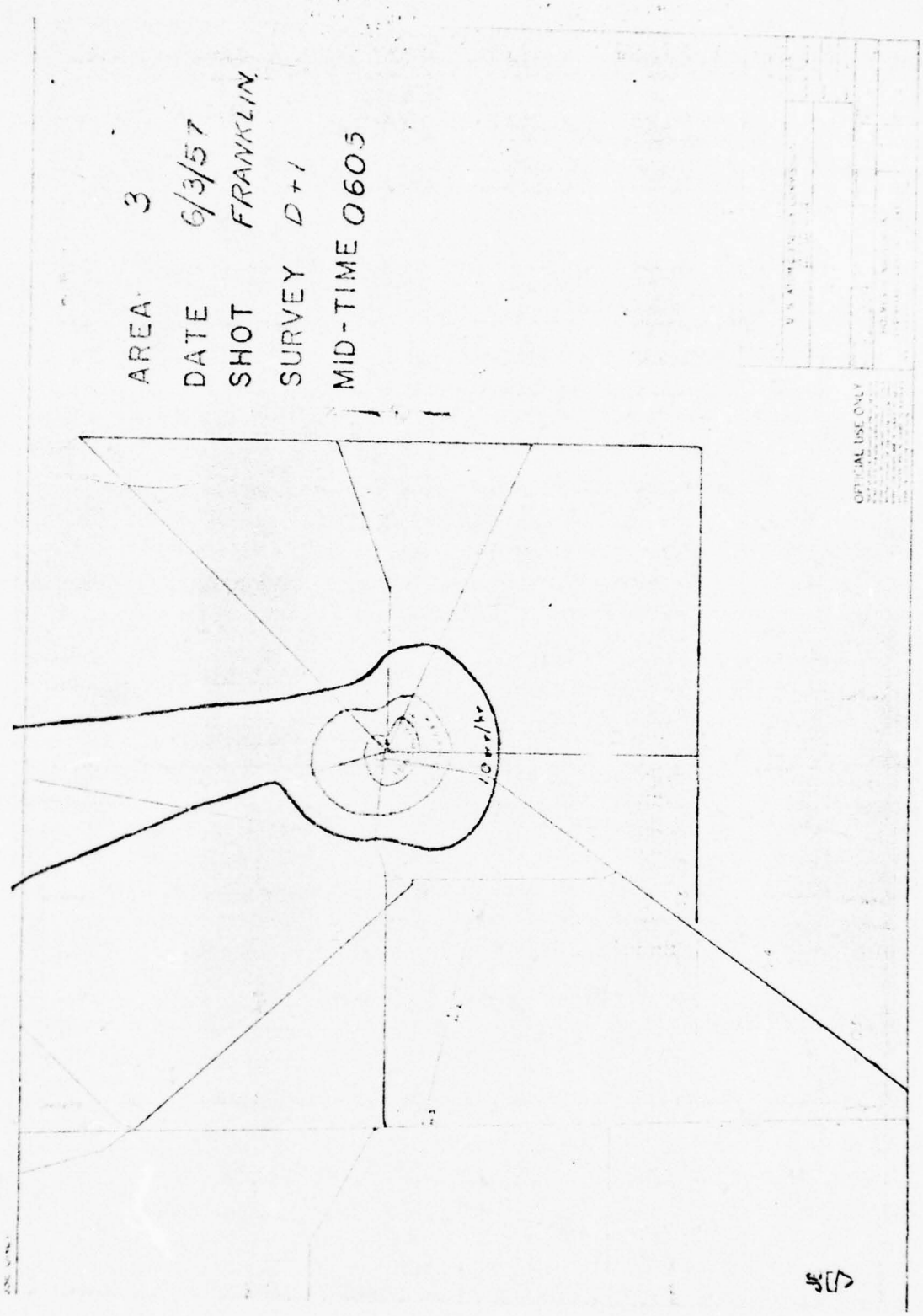

Figure 3.4.2 Franklin, D + 1

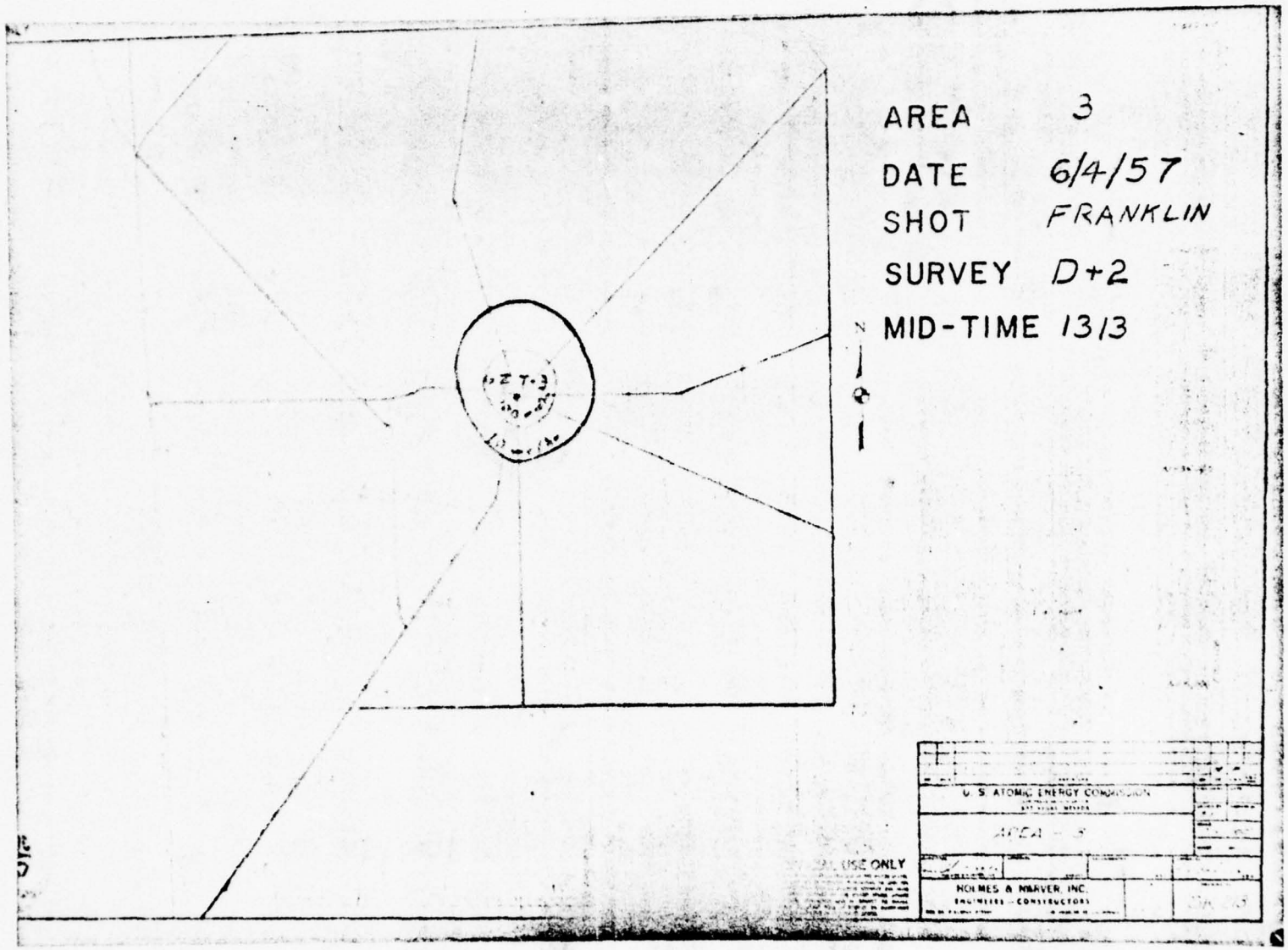

Figure 3.4.3 Franklin, D + 2.

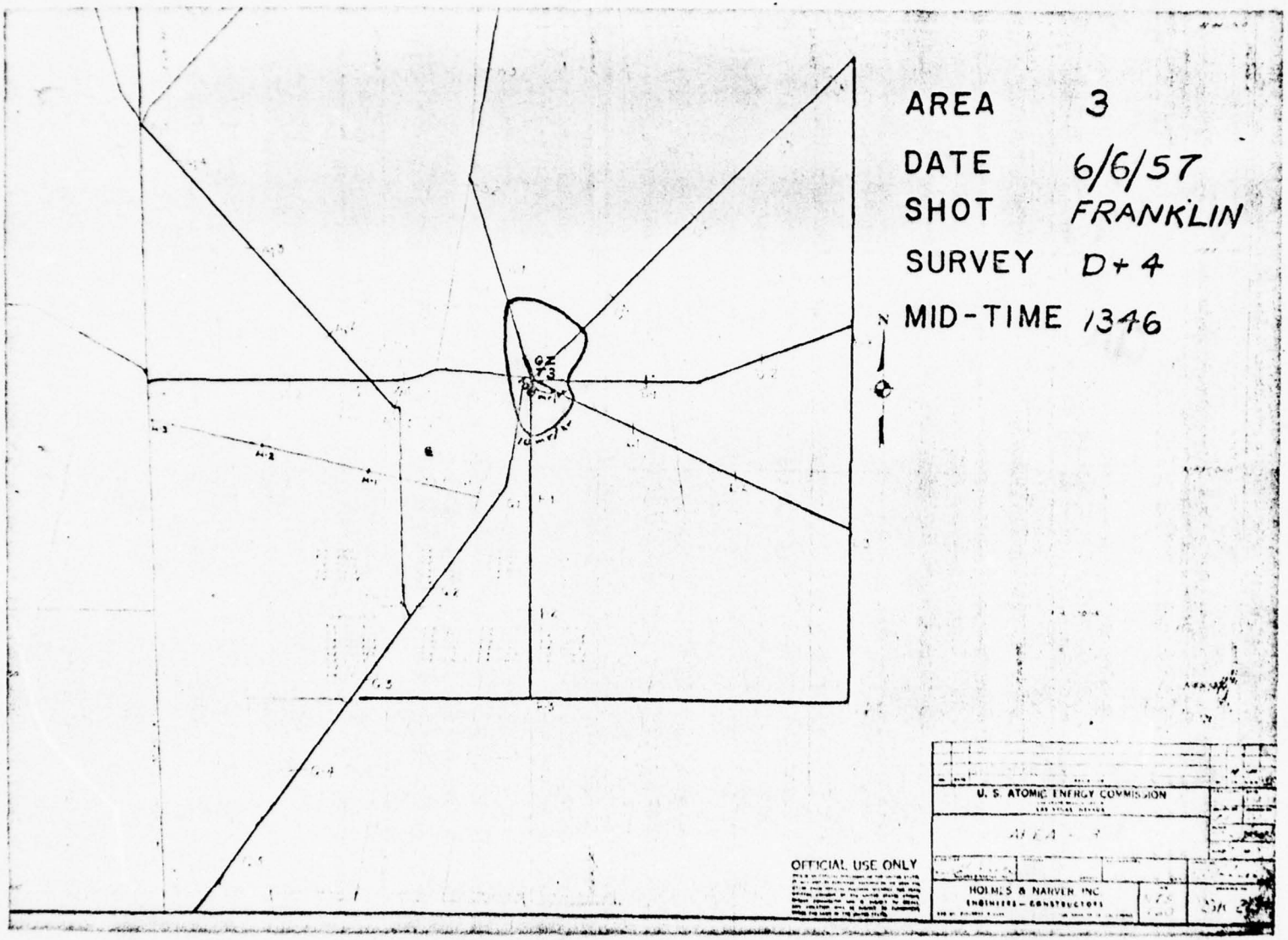

Figure 3.4.4 Franklin, D + 4

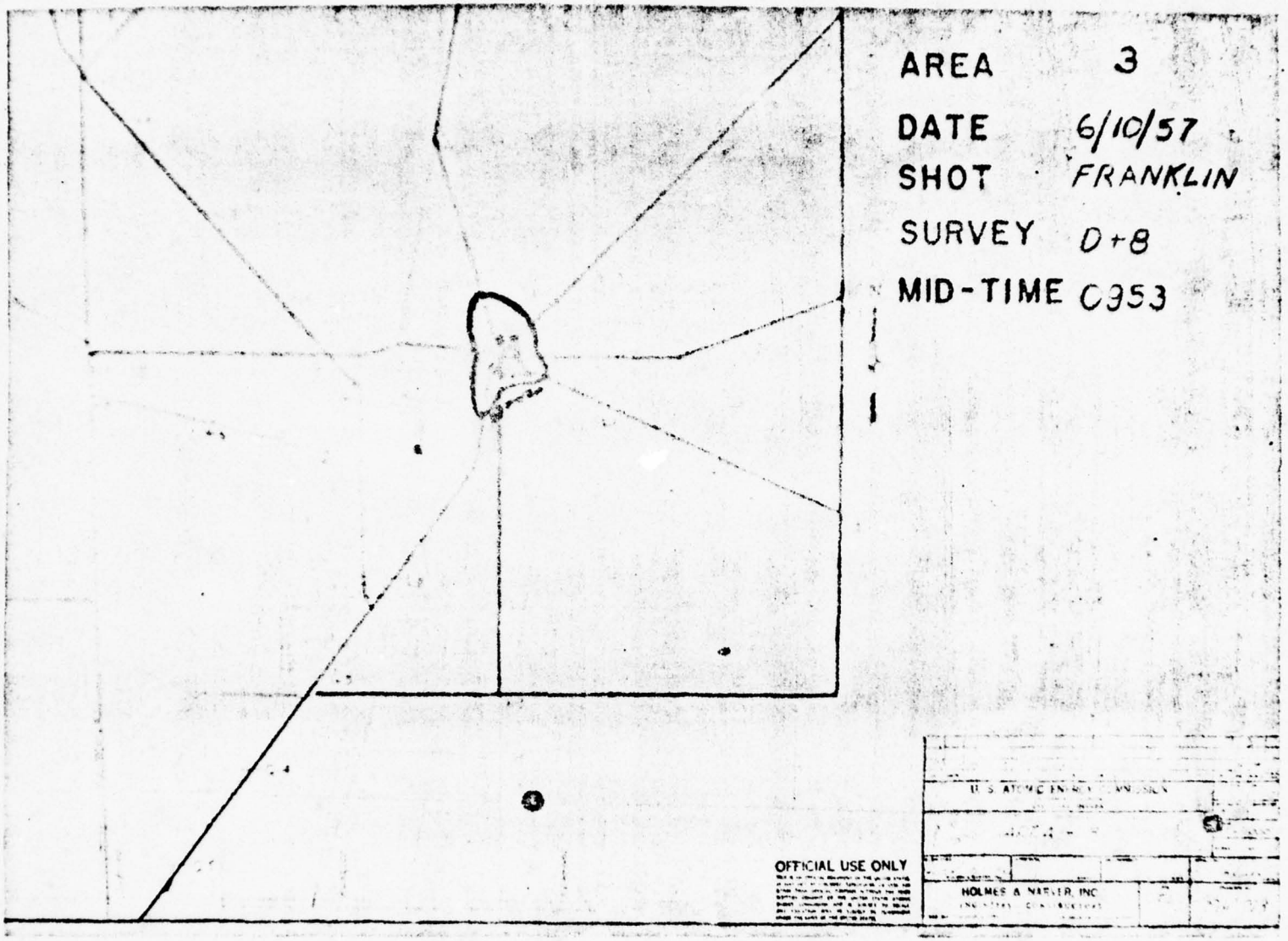

Figure 3.4.5 Franklin, D + 8

3.4.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 882 people as follows:

Item	Number
Coveralls	388
Shoe Covers (pairs)	1135
Respirators	929

The laundry processed 5665 pieces of anti-contamination items.

The stock and issue facilities at the CP-2 remained open on a twenty-four hour basis.

3.5 Lassen (June 4 through June 16, 1957)

Lassen was a device, with very low planned yield, fired from a 500-foot balloon anchored at an altitude of 500 feet above Area 9. The device was detonated at 0445 hours on June 5, 1957. A few seconds after a brief flash occurred, a small cloud rose to approximately 6000 feet MSL and drifted slowly to slightly north of east producing very little fallout.

3.5.1 General Monitoring Branch

The aerial survey team departed at 0500 hours and proceeded on a predetermined course over Area 9 and other areas of interest. The following readings were obtained at an altitude of 25 feet:

Intensity mr/hr	Location	Time hours	Area
8	SE Winch House	0538	9
4	W Winch House	0540	9
6	N Winch House	0541	9
280	Ground Zero	0612	9
250	Ground Zero	0532	3
1000	Ground Zero	0535	7
1	Work Area	0544	2c
4	Ground Zero	0551	10
Background	Work Area	0559	12
5	Work Area	0603	2, 2a, 2b
Background	Work Area	0612	1

The initial aerial survey was completed at 0615

Ground initial survey teams departed at 0500 hours. The contaminated area was found to be small. The 1 r/hr line extended approximately 150 yards from ground zero. The mid-time of this survey was 0527 hours. At 0540 hours a ground surface alpha reading of 4.5×10^3 c/m was obtained at a point 250 feet south of ground zero. Rad-Safe net control was notified and the area was closed by the Test Director at 0852 hours.

A ground survey of non-shot areas was made at 0500 hours. The only significant readings obtained were as follows:

Intensity mr/hr	Location	Time hours	Area
2.5	Ground Zero	0520	1
10	Work Area	0613	2a

At 0510 hours a Rad-Safe check station was established to control access into Area 9. Decontamination procedures were started on D-day and the area was declared a non-radex area at 2000 hours on D / 1. Roving monitors were utilized to control access into Areas 3 and 7.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours	Survey Type
June 6	D / 1	0900	Alpha

The H / 6 hours survey was not made because security controlled the area.

There were two party monitors provided to projects and for REECO support.

3.5.2 Plotting and Briefing Branch

Results of the surveys were plotted for display at various locations. (Figure No. 3.5.1).

A re-survey for alpha contamination was conducted at 0900 hours on D / 1, and the area was declared non-radex at 2000 hours.

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
D-day	17	12	79
D / 1	10	5	33
Totals	27	17	112

3.5.3 Decontamination Branch

The following items were decontaminated at the CP-6:

Equipment	Number
Vehicles	124
Electric Generator	1

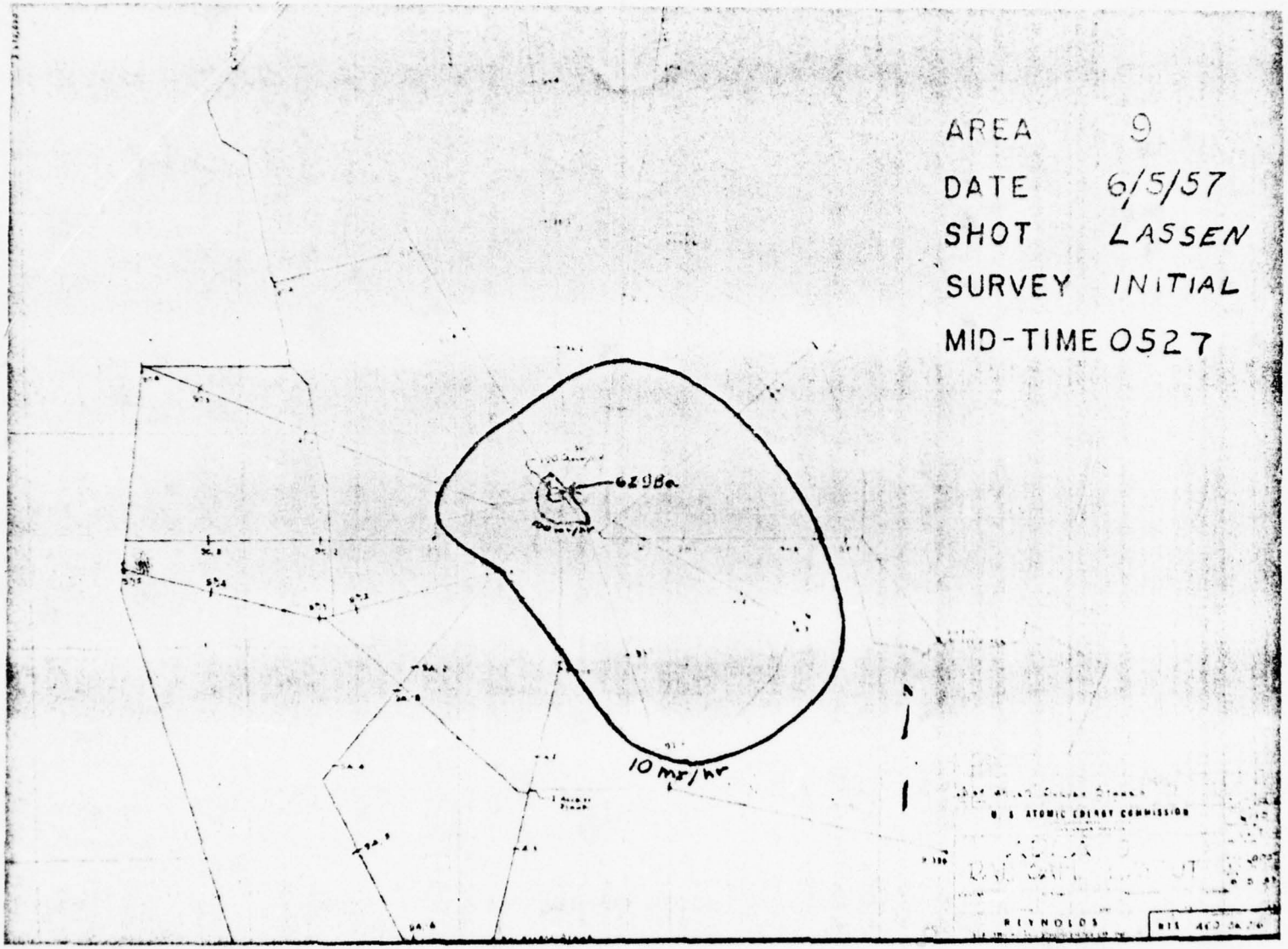

Figure 3.5.1 Lassen, Initial

3.5.4 · Special Assignments Branch

A total of 144 vehicles from Project 3.8, DOD, were monitored and cleared for release from the Nevada Test Site.

No significant radiation levels were encountered on the highway between the CP-2 and Mercury after the detonation.

Air-borne Radioactivity (D-day Averages):

Air Samples:

Location	Long-Lived Alpha d/m per M^3
Warehouse 6	Background
CP-2	Background
Area 2	Background
Gate 385	Background
Area 13	Background

Fallout Trays:

Location	Long-Lived Alpha d/m per ft^2
CP-2	17
Area 2	Background
Gate 385	4.8×10^3
Well 5b	Background
Shot Area (Average)	14

No increase in radioactivity was noted in well and drinking water samples.

Radiation surveys in "clean working and living areas" in Mercury and the CP Area were negative.

Film badges placed prior to the shot and collected at H / 48 hours indicated the following gamma exposures:

Location	Exposure
Gate 13	70 mr
Gate 385	50 mr

A special beta-gamma contamination survey was conducted at Building 501 in Mercury. Floor scanner and MX-5 results were negative. Maximum contamination obtained from swipes was 40 d/m per ft^2.

The following samples were analyzed in the laboratory:

Type	Number
Air Sample	118
Nasal Swabs	255
Surface Swipes	1612
Fallout Trays	137
Water Samples	16
Total	2138

3.5.5 Training Branch

Hourly Health and Safety lectures were given each day at Building 111 to new Nevada Test Site personnel.

The Basic Rad-Safe Monitor Training Course was given to 46 DOD, Edgerton-Germeshausen and Grier, (EG&G), and Rad-Safe Division personnel.

A two-hour re-orientation lecture and tour was given to 10 DOD personnel at the CP-2.

A one-hour lecture on proper use of Rad-Safe anti-contamination clothing was given to 12 FSI personnel at Building 111.

A discussion of Rad-Safe operations was given to approximately 42 members of the Boulder Dam Section of the American Chemical Society

3.5.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
June 4	316	741
June 5	247	248
June 6	235	242
June 7	123	185
June 8	86	115
June 9	61	6
June 10	144	149
June 11	94	101
June 12	75	363
June 13	53	800
June 14	76	400
June 15	84	1020
June 16	48	31
Totals	1642	4401

Dosimeters:

Date	Issued	Received
June 4	115	110
June 5	186	176
June 6	39	37
June 7	78	88
June 8	5	5
June 9	1	1
June 10	0	0
June 11	0	0
June 12	6	6
June 13	144	22
June 14	8	4
June 15	0	0
June 16	0	6
Totals	582	455

On June 6, this branch issued 2500 film badges to the Off-Site Rad-Safe Organization.

On June 13, approximately 2200 film badges were received from the Off-Site Rad-Safe Organization for processing and reporting.

3.5.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 1123 people as follows:

Item	Number
Coveralls	556
Shoe Covers (pairs)	931
Respirators	856
Other Items	2394

The laundry processed 8232 pieces of anti-contamination item.

3.6 Wilson (June 17 through June 22, 1957)

Wilson was a device fired from a balloon suspended 500 feet above Area 9. The device was detonated at 0445 hours on June 18, 1957. The mushroom cloud rose to above 30,000 feet MSL with the top separating cleanly from the stem and being blown north of due east at about 12 knots. The cloud stem dragged at low altitude, moved more rapidly in the middle, and more slowly near the top, making it spread Out in a long "V". The section below 20,000 feet was blown very slowly to slightly north of due west.

Surface winds were predicted light and variable prior to the detonation, with some possibility of light winds out of the north. Therefore, shortly after the detonation observers were evacuated from the Control Point and surrounding area as a precautionary measure. The ventilation system of the CP-2 was turned off. All

building entrances with the exception of the entrance to personnel decontamination facilities were secured to minimize spread of the anticipated radioactive fallout. A minimum number of Rad-Safe personnel remained at CP-2, to provide necessary support to participating agencies.

3.6.1 General Monitoring Branch

The aerial survey was postponed in accordance with the Test Director's evacuation order at 0450 hours. The team departed from the helicopter pad at the Control Point at 1145 hours. Flying a predetermined course, the team made three surveys over the shot area at altitudes of 25, 50, and 100 feet. Six predetermined points were checked on each of these surveys over Area 9. Pertinent data obtained at a mid-time of 1201 hours is as follows:

Intensity mr/hr	Location	Altitude feet
35	N 871.00, E 6795.75	25
40	N 871.00, E 6795.75	50
45	N 871.00, E 6795.75	100
200	North Winch Site	25
200	North Winch Site	50
175	North Winch Site	100
75	Southeast Winch Site	25
50	Southeast Winch Site	50
70	Southeast Winch Site	100
200	West Winch Site	25
175	West Winch Site	50
100	West Winch Site	100
200	9-300 Bunker	25
275	9-300 Bunker	50
250	9-300 Bunker	100
100,000	Ground Zero	25
75,000	Ground Zero	50
60,000	Ground Zero	100

The aerial survey team flying at an altitude of 25 feet obtained the following intensities in other areas:

Intensity mr/hr	Area	Time hours
5	3	1150
350	7	1153
0	10	1208
3	2c	1029
0	12	1212
0	2	1215
25	4	1220
6	1	1221

The initial ground survey was delayed until 0607 hours. The mid-time of this survey was 0639 hours.

. Check stations to control access into contaminated areas were established at the BJY, Area 4, and Area 9 access roads.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
June 18	D / 1/4	1131
June 19	D / 1	0529
June 20	D / 2	0523
June 21	D / 3	0524
June 23	D / 5	0837
June 27	D / 9	0718

There were 10 monitors assigned to projects and REECO support, and three monitors retained on standby.

3.6.2 Plotting and Briefing Branch

Results of the surveys were plotted for display at various locations. (Figures No. 3.6.1 through 3.6.5).

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
D-day	71	24	290
D / 1	27	9	144
D / 2	12	7	41
D / 3	29	7	123
D / 4	17	11	87
Totals	156	58	685

3.6.3 Decontamination Branch

The following items were decontaminated at the CP-6:

Equipment	Number
Vehicles	72
Electrical Instruments	35

3.6.4 Special Assignments Branch

The following radio active material was monitored and cleared for release from the Nevada Test Site:

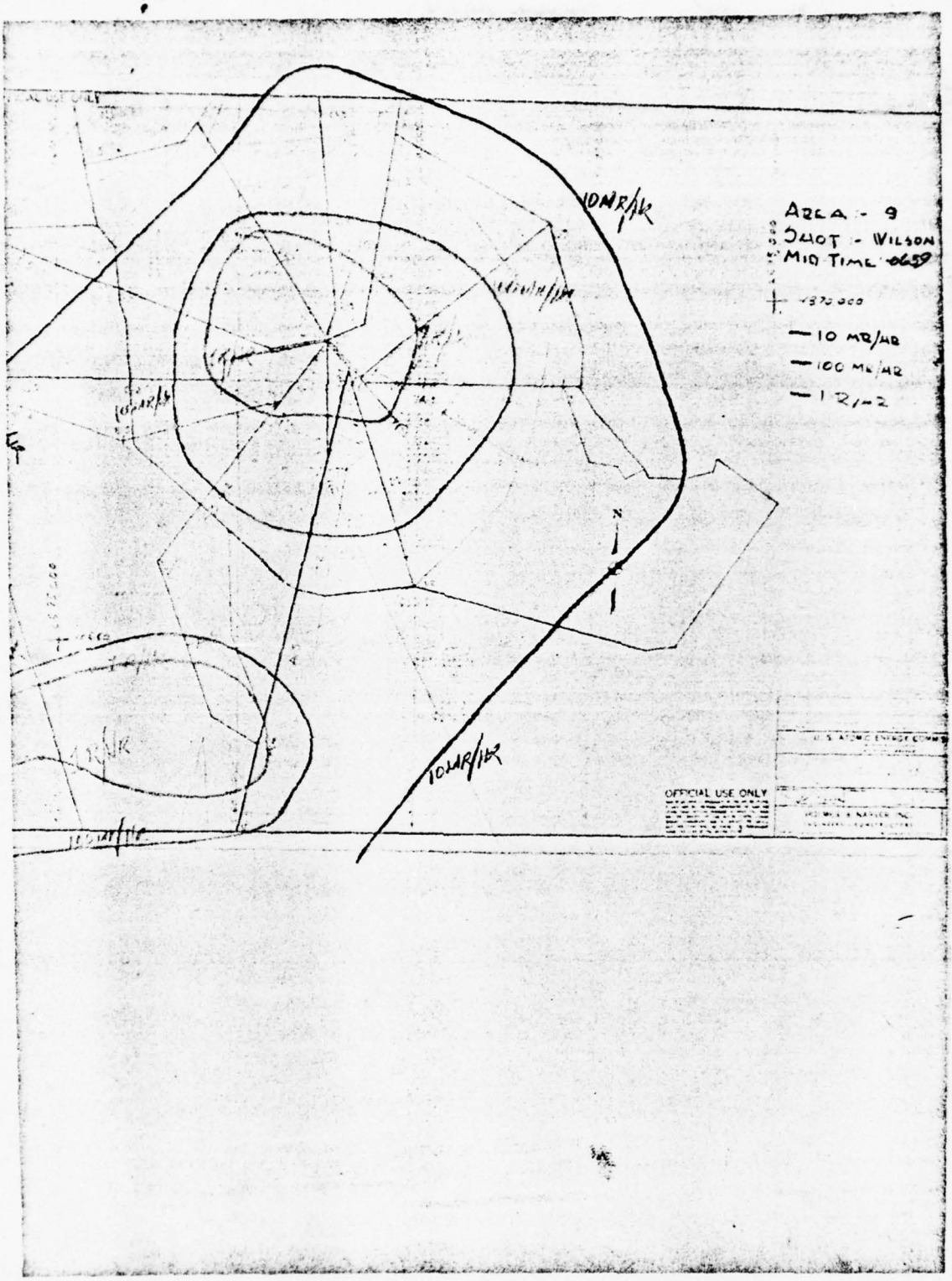

Figure 3.E.1 Wilson, Initial

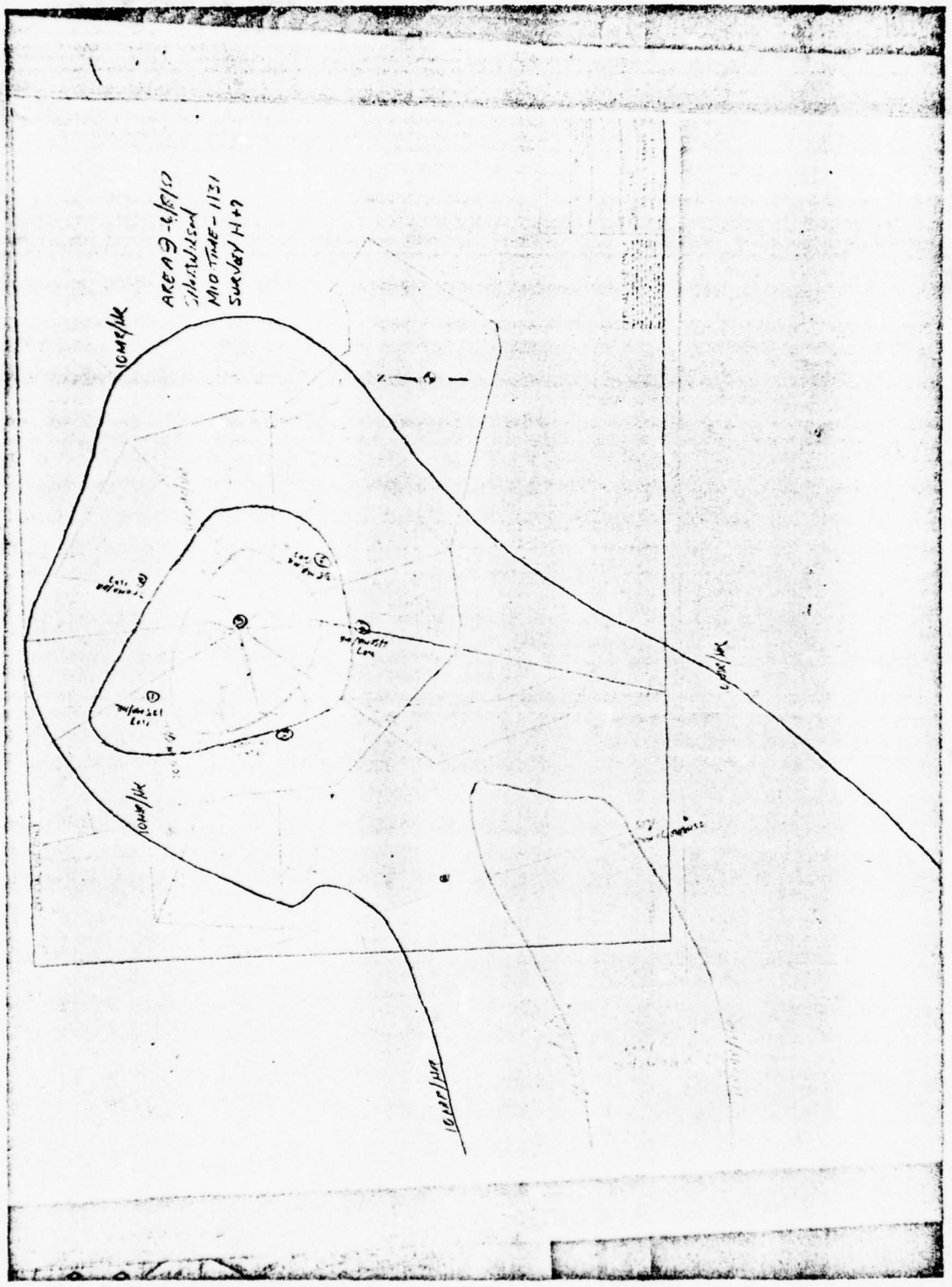

Figure 3.6.2 Wilson, H + 7

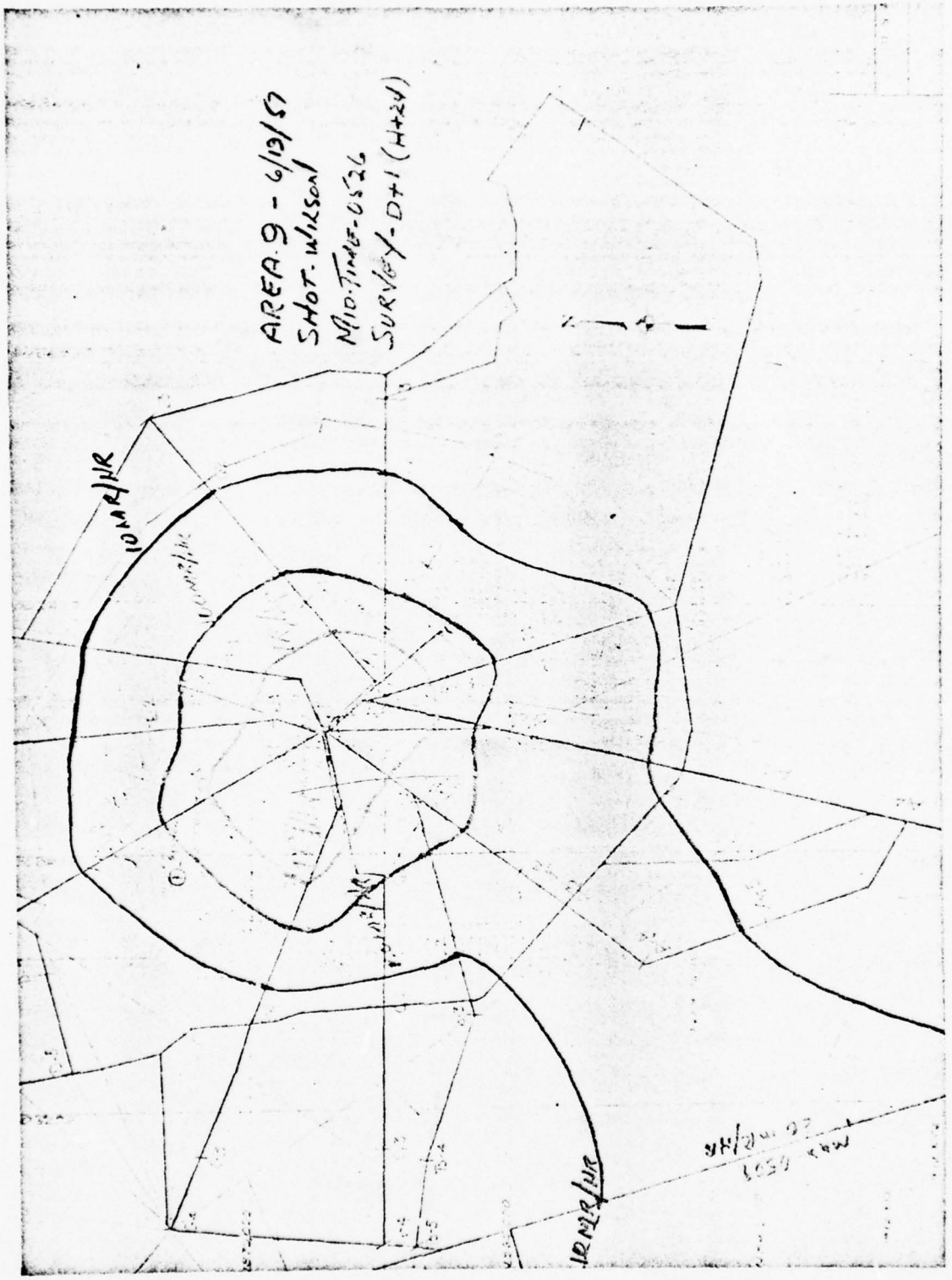

Figure 3.6.3 Wilson, D + 1

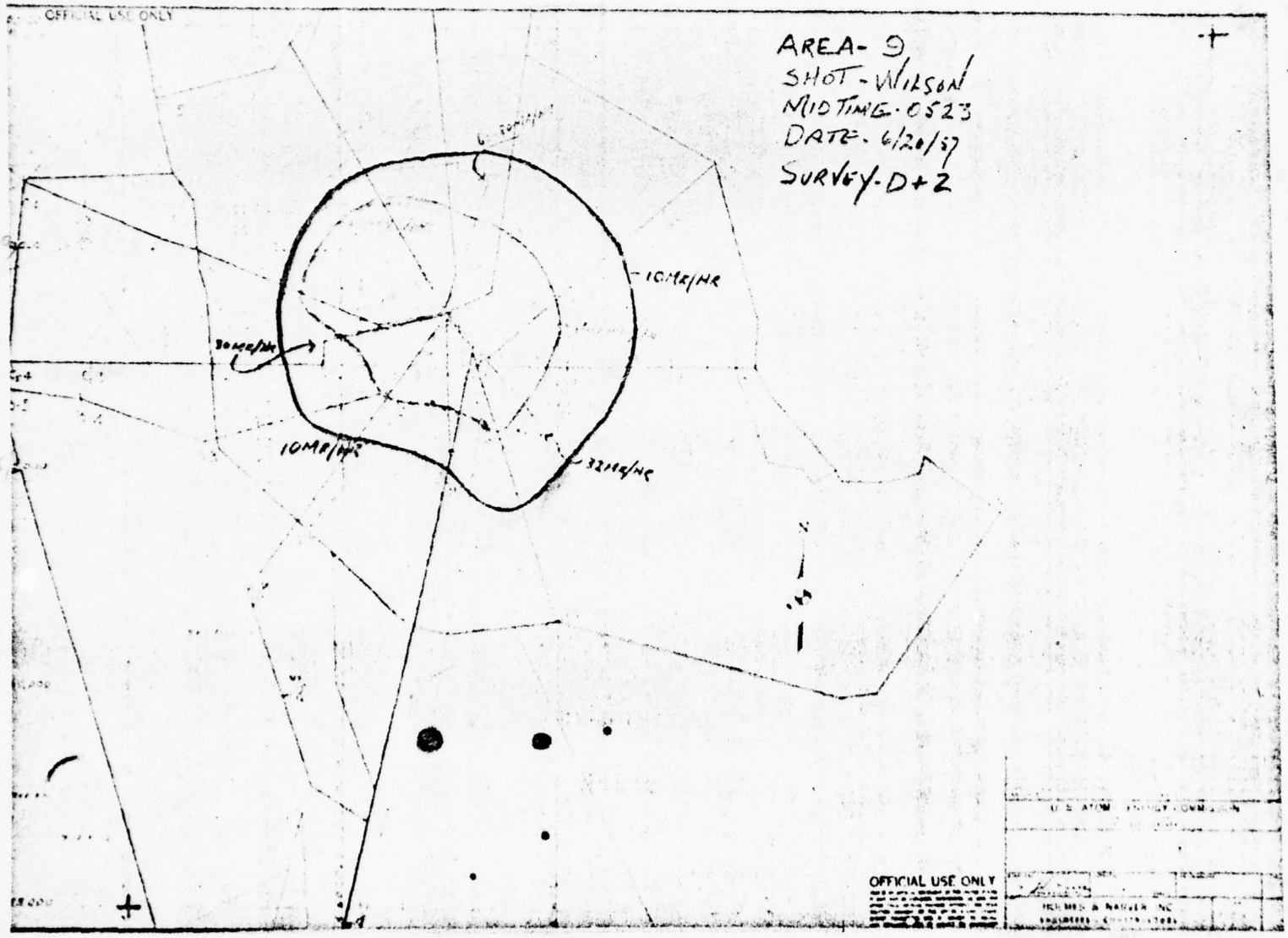

Figure 3.6.4 Wilson, D + 2

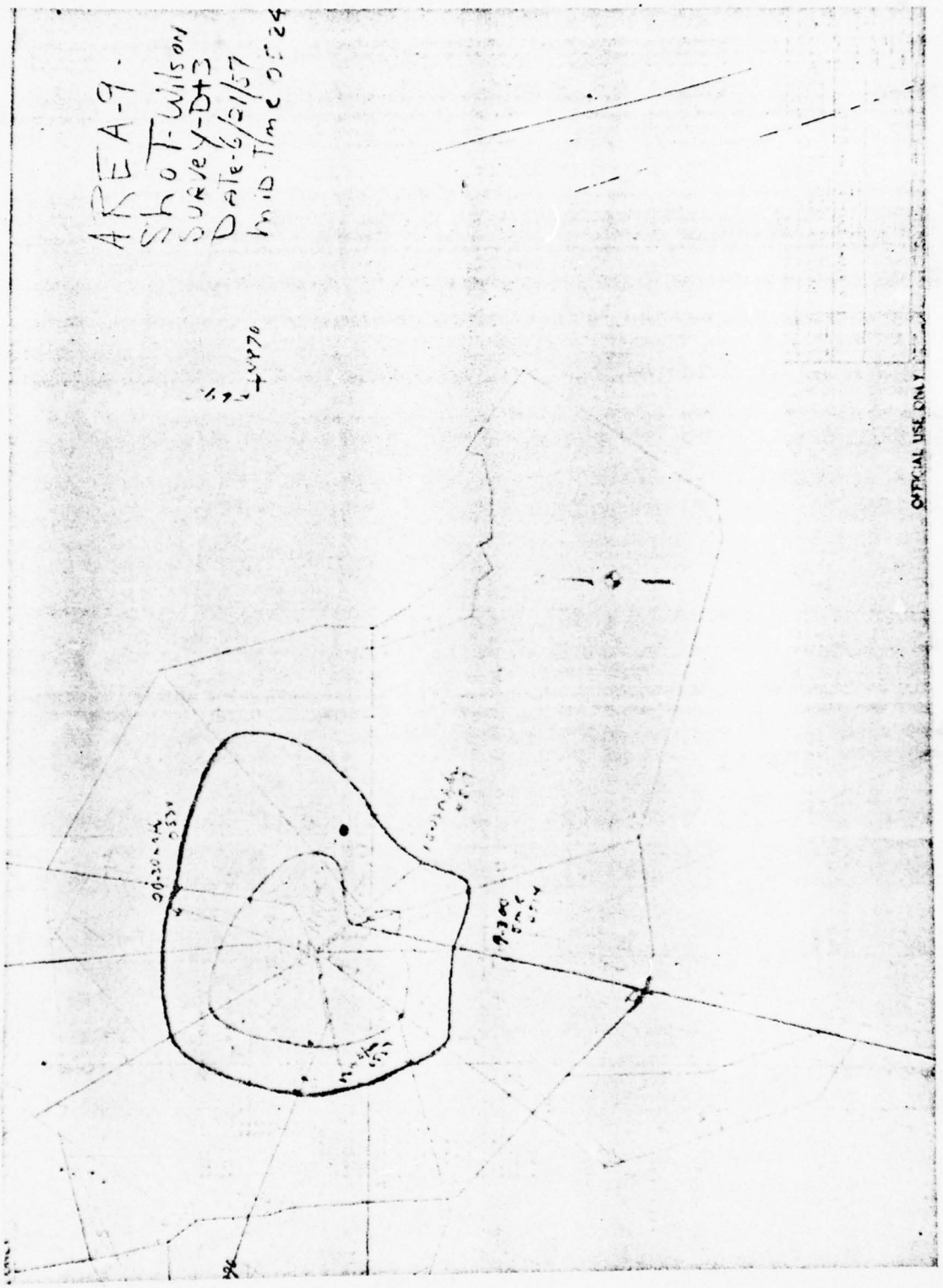

Figure 3.6.5 Wilson, D + 3

Material	No. of Boxes	Agency
Soil Samples	4	Program 3.8
Soil Samples	1	Project 2.2
Metal Samples	2	Sandia Corp.

Air-borne Radioactivity (Three-Day Averages):

Air Samples:

Location	Long-Lived Alpha d/m per M^3
Warehouse 6	Background
CP-2	0.1
Area 2	0.3
Gate 385	0.4
Area 13	0.2

Fallout Trays:

Location	Long-Lived Alpha d/m per ft^2
Warehouse 6	34
Well 5	128
CP-2	370
Area 2	84
Gate 385	84
Area 13	17
Shot Area (Average)	50

No increase in radioactivity was noted in well and drinking water samples.

Radiation surveys in "clean working and living areas" in Mercury and the CP Area were negative.

The total accumulated dosage as determined by film badges at Security Gate 385 for the 72-hour period immediately following the detonation was 38 mr.

The following samples were analyzed in the laboratory:

Type	Number
Air Samples	98
Nasal Swabs	124
Surface Swipes	708
Fallout Trays	61
Water Samples	6
Total	997

3.6.5 Training Branch

A four-hour Rad-Safe lecture was given to Program 36, CETG, participants on June 19 This was followed on June 20 by a two-hour Rad-Safe procedure and orientation tour of CP-2.

A lecture on Radiation and Radiological Safety was given to a group of approximately 50 FCDA visitors. Training Branch personnel accompanied this group on a four-hour tour of the Frenchman Flat Area.

A two-hour re-indoctrination lecture and tour was given to five CETG personnel on June 22, and to two DOD personnel on June 24, at CP-2.

3.6.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
June 17	84	140
June 18	461	382
June 19	291	186
June 20	220	125
June 21	209	100
June 22	702	144
Totals	1957	1077

Dosimeters:

Date	Issued	Received
June 17	0	0
June 18	275	217
June 19	45	20
June 20	56	25
June 21	44	40
June 22	23	20
Totals	443	322

3.6.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 703 people as follows:

Item	Number
Coveralls	521
Shoe Covers (pairs)	643
Respirators	422

The laundry processed 7788 pieces of anti-contamination items plus 595 pieces for Indian Springs Air Force Base, (ISAFB), personnel.

A general search of Yucca Flat, Frenchman Flat, and the Mercury area resulted in the collection of the following:

Item	Number
Coveralls	52
Shoe covers (pairs)	34
Respirators	227
Total	313

3.7 Priscilla (June 23 through July 3, 1957)

Priscilla, a Military Effects shot, was a device suspended from a balloon 700 feet above Frenchman Flat. The device was detonated at 0630 hours on June 24, 1957. The mushroom top of the cloud rose rapidly to above 40,000 feet MSL. It moved in a direction slightly north of due east at a speed of about 22 knots.

3.7.1 General Monitoring Branch

The aerial survey team could not carry out its mission because of severe dust conditions. The survey was attempted at 1119 hours but heavy dust still obscured ground points and the helicopter returned to its Frenchman Flat access road pad at 1136 hours. At 1305 hours the team was able to make a survey over a predetermined course defined by an arc extending from 230° to 295° at a radius of 2200 feet from ground zero. The results of this survey were as follows:

Intensity r/hr	Location	Altitude feet
8	South End of Arc	50
7	Center of Arc	50
0.5	North End of Arc	50

The helicopter returned to its pad at 1335 hours. Results of aerial surveys over ground zero in Frenchman Flat were as follows:

Intensity r/hr	Day	Altitude feet	Time hours
100	D / 1	500	0915
8	D / 2	500	0913
30	D / 2	200	0915

The ground initial survey of the shot area was temporarily delayed by severe dust conditions. The mid-time of this survey was 0809 hours.

Six survey monitors determined radiation levels in Areas 1, 2, 3, 4, 7, 9, 12, and Jackass Flats. No increase in activity as a result of the shot was detected.

Check stations to control access into the contaminated areas were established at Well 5B, the junction of the Short Pole Line with Mercury Highway, and the junction of Frenchman Flat access road with Mercury Highway.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
June 24	D / 1/4	1308
June 25	D / 1	0658
June 26	D / 2	0550
June 27	D / 3	0548
June 28	D / 4	0909
June 29	D / 5	0846
July 1	D / 7	0627

Because of security restrictions, only "Q" cleared personnel were permitted to perform the above re-surveys.

There were 10 monitors assigned to projects and for REECO support.

3.7.2 Plotting and Briefing Branch

Results of the surveys were plotted for display at various locations. (Figures No. 3.7.1 through 3.7.5).

A secondary briefing and area access permit facility was established in the Frenchman Flat area to expedite recovery operations.

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
D / 1	117	41	541
D / 2	32	13	158
D / 3	55	10	194
D / 4	39	14	157
D / 5	55	12	147
D / 6	10	7	26
D / 7	42	12	87
D / 8	47	18	130
D / 9	38	11	90
D / 10	16	9	52
Totals	451	147	1582

3.7.3 Decontamination Branch

The following items were decontaminated at the CP-6:

Equipment	Number
Vehicles	138
Mines and Fuses	30
Pressure Time Gauges	30
Sample Holders	26

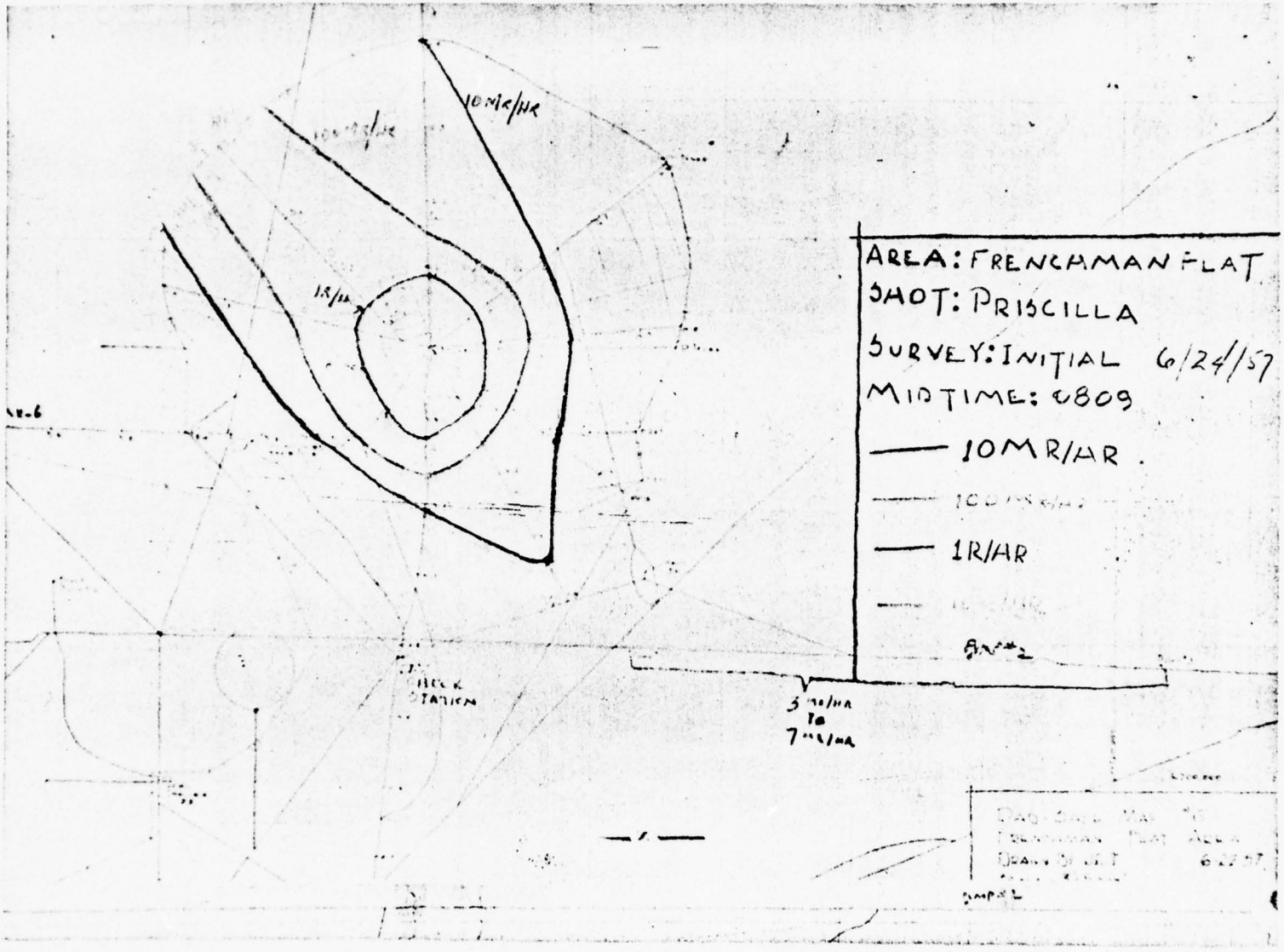

Figure 3.7.1 Priscilla, Initial

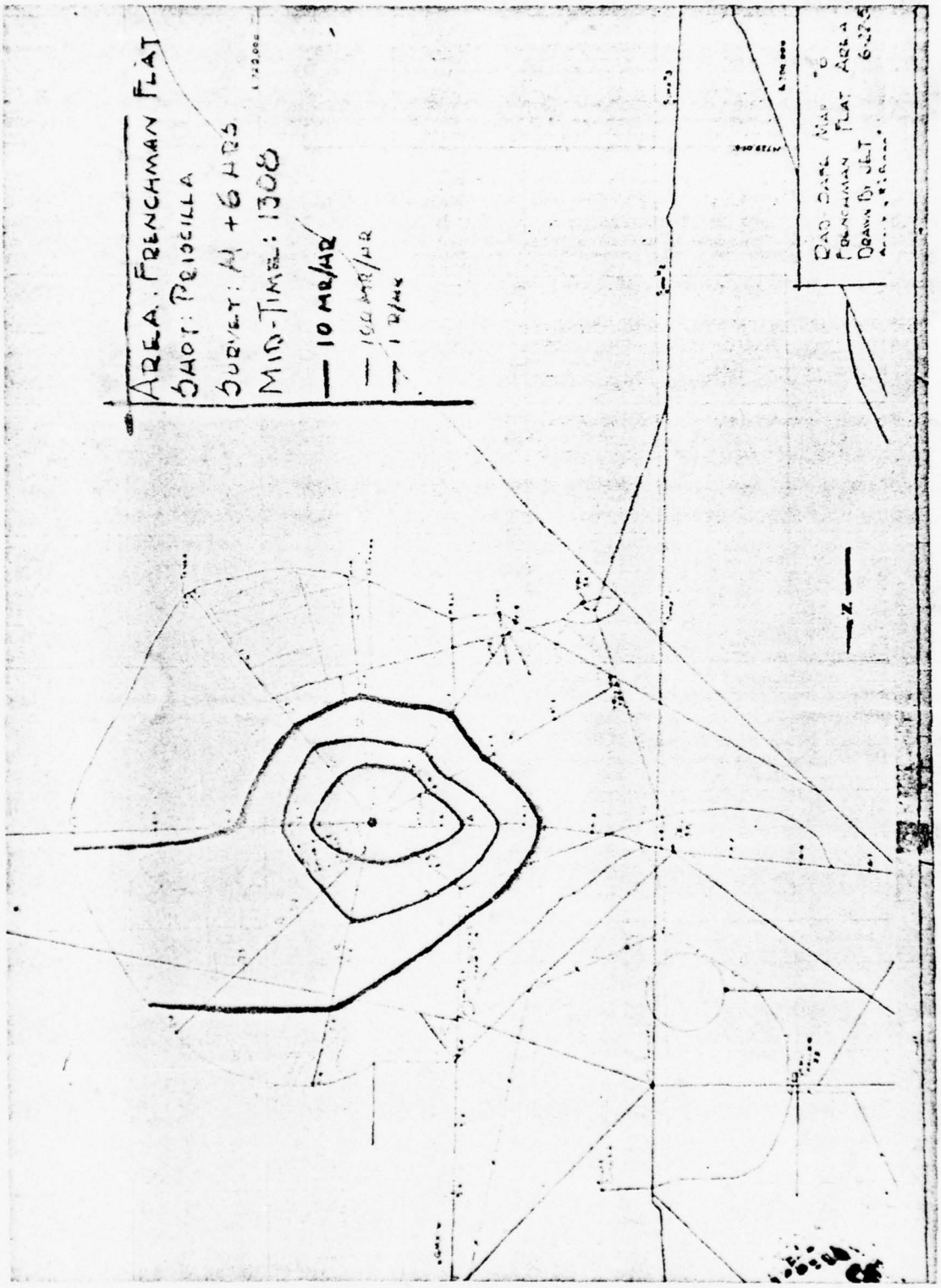

Figure 3.7.2 Priscilla, H + 6

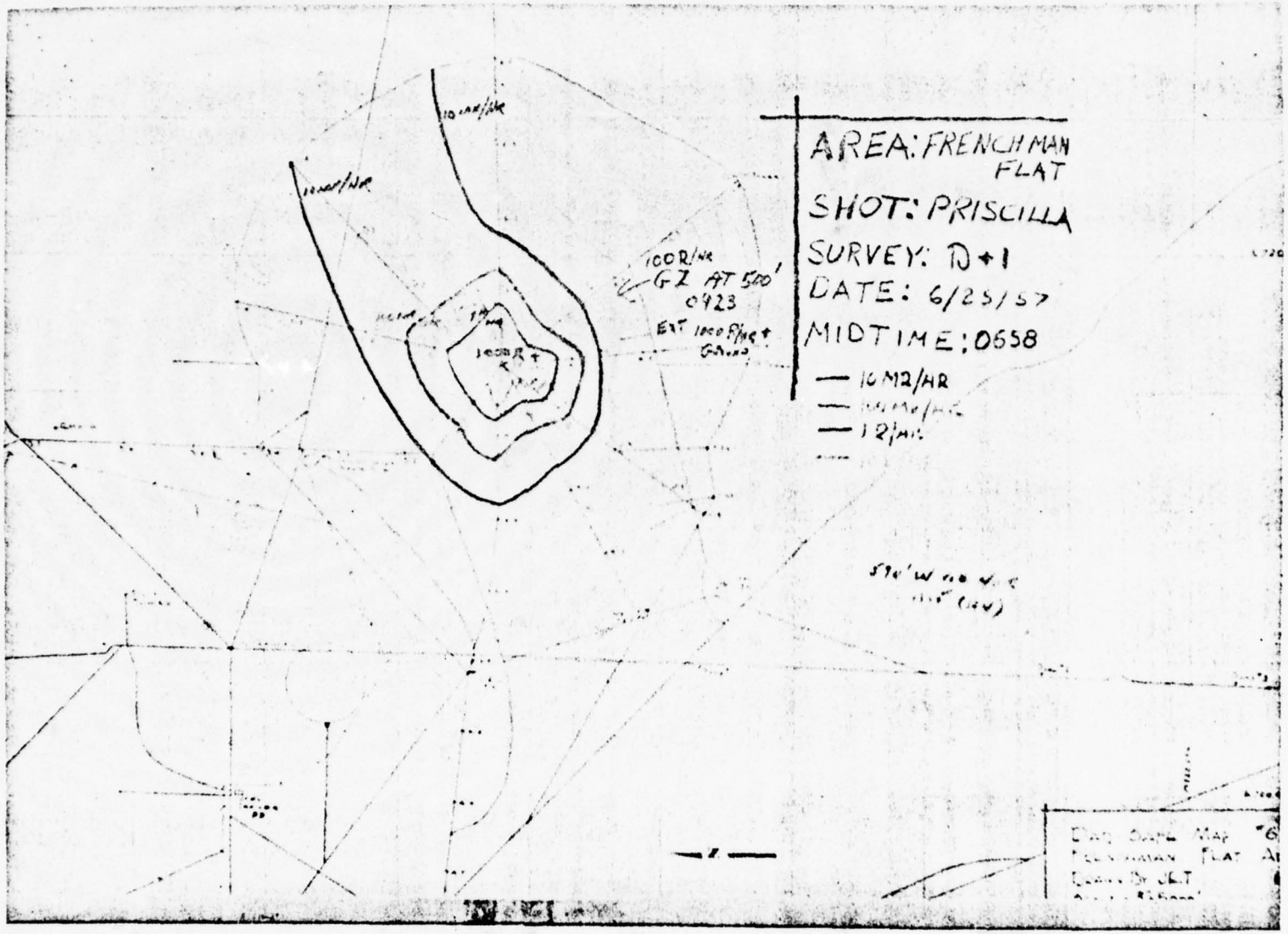

Figure 3.7.3 Priscilla, D + 1

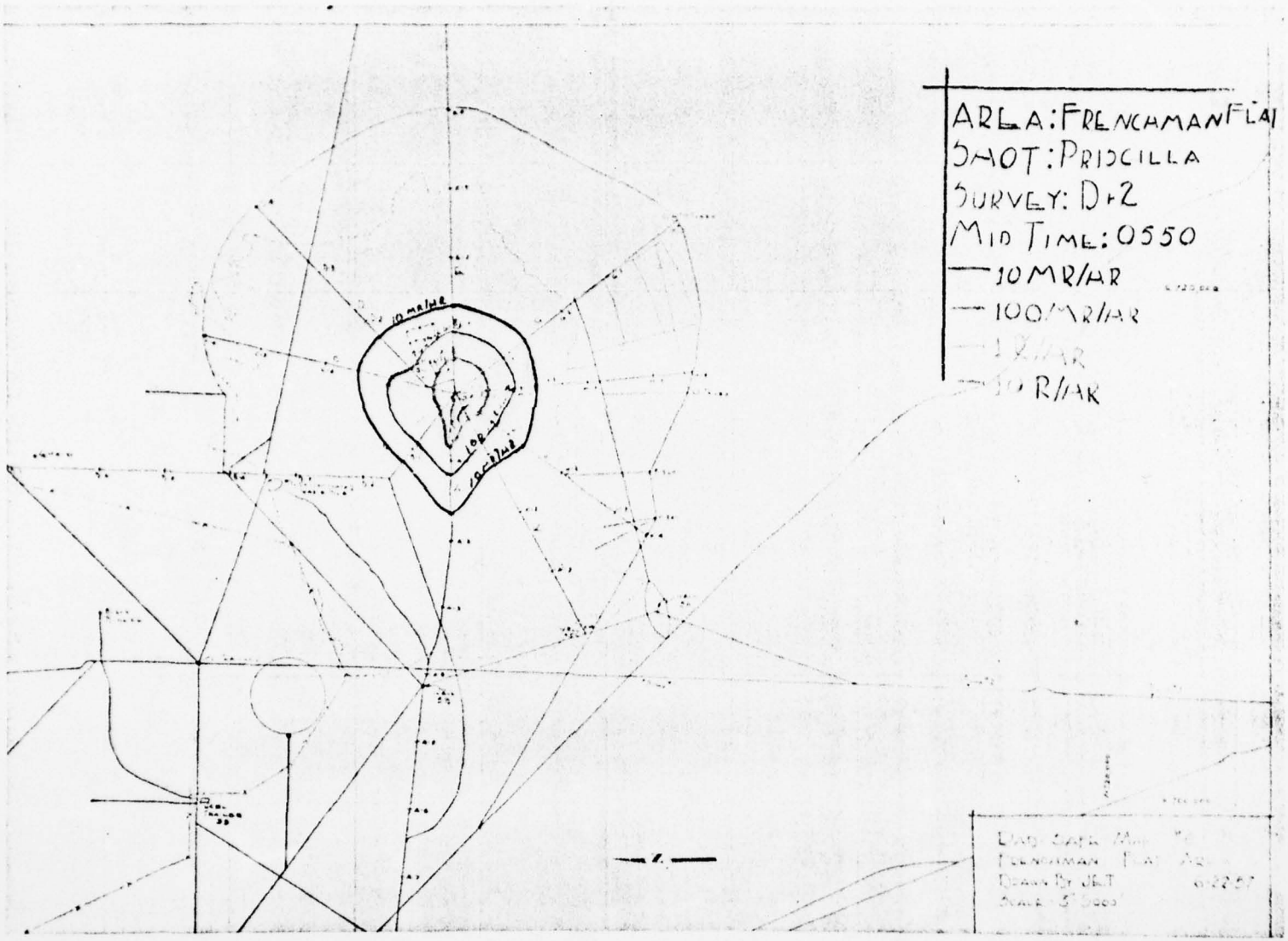

Figure 3.7.4 Priscilla, D + 2

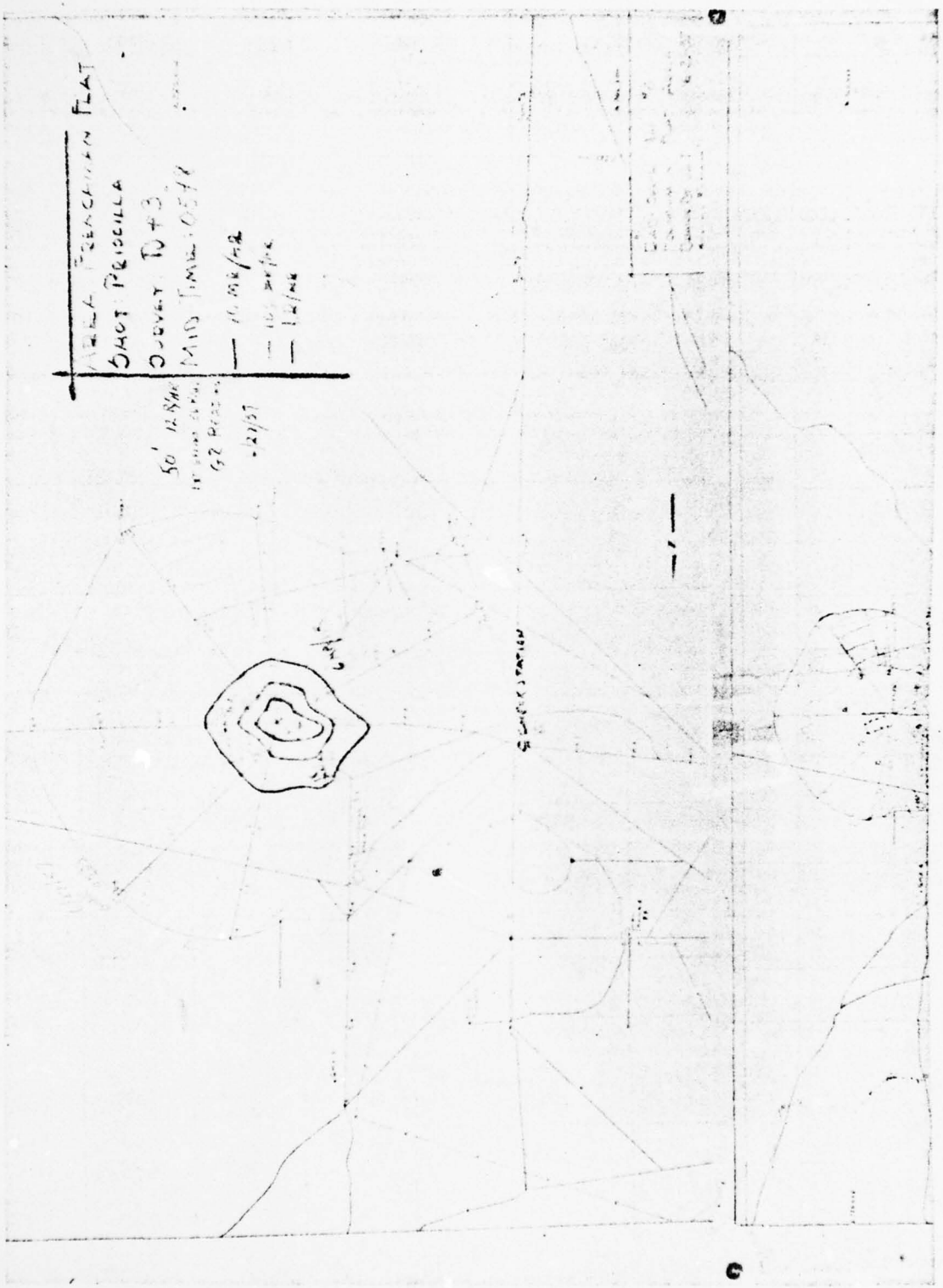

Figure 3.7.5 Priscilla, D + 3

A total of 40 vehicles were processed at the Frenchman Flat Field Decontamination facility.

3.7.4 Special Assignments Branch

The following radioactive material was monitored and cleared for release from the Nevada Test Site:

Material	No. of Boxes	Agency
Wheat	54	Project 28.2
Soil	3	Sandia Corp.

The following soil samples were obtained at the request of Sandia Corporation:

Location	Number
Area 13	18
Area 9 Ground Zero	4
Frenchman Flat (Inside the 100 mr/hr contour line)	4

No significant radiation levels were encountered on the highway between the CP-2 and Mercury after the detonation.

Air-borne Radioactivity (D-day Averages):

Air Samples:

Location	Long-Lived Alpha d/m per M^3
Warehouse 6	Background
CP-2	Background
Area 2	Background
Gate 385	Background
Area 13	Background

Fallout Trays:

Location	Long-Lived Alpha d/m per ft^2
Warehouse 6	Background
Well 5	101
CP-2	Background
Area 2	Background
Gate 385	50
Area 13	84

No increase in radioactivity was noted in well and drinking water samples.

Radiation surveys in "clean working and living areas" in Mercury and the CP Area were negative.

The following samples were analyzed in the laboratory:

Type	Number
Air Samples	64
Personnel Swipes	105
Surface Swipes	497
Fallout Trays	37
Water Samples	6
Total	709

3.7.5 Training Branch

Rad-Safe orientation lectures were given to military, Los Alamos Scientific Laboratory, (LASL), and FCDA observers. About 156 persons were present. A discussion was held with members of the Las Vegas Valley Business and Professional Women's Club by a member of the Branch. The three-day basic training course was given for DOD and REECO personnel.

3.7.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
June 23	133	105
June 24	743	667
June 25	889	1226
June 26	1578	551
June 27	1025	1090
June 28	898	166
June 29	196	1013
June 30	83	166
July 1	829	1048
July 2	137	137
July 3	28	362
Totals	6604	6531

Dosimeters:

Date	Issued	Received
June 23	301	301
June 24	205	220
June 25	55	260
June 26	57	100
June 27	212	130
June 28	0	0
June 29	10	10
June 30	0	0

Date	Issued	Received
July 1	11	11
July 2	0	0
July 3	0	0
Totals	851	1032

3.7.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 1011 people as follows:

Item	Number
Coveralls	567
Shoe Covers (pairs)	897
Respirators	370
Miscellaneous	2254

The laundry processed 8359 pieces of anti-contamination items.

A total of 335 sets of pre-packaged clothing for entry into full radex areas were issued to DOD personnel for the Priscilla event.

3.8 Coulomb "A" (July 1, 1957)

Coulomb "A" was detonated on the ground surface in Area 3h at 1030 hours on July 1, 1957. This was the second safety experiment of the Plumbbob series. A small cloud rose to about 1000 feet MSL.

3.8.1 General Monitoring Branch

The initial ground survey departed from Station 351 at H / 1 minute. The monitoring personnel determined the gamma radiation level to be 2 mr/hr at ground zero. An alpha survey revealed 15,000 c/m/55 cm^2 at the same location. An extensive alpha survey was carried out in an area confined within a 50 yard radius around ground zero. A general level of 15,000 c/m/55 cm^2 was detected in this area.

The check station was placed in operation at H / 10 minutes at a point 300 yards south of the 2-300 Bunker. Check station operation was discontinued after D / 1 day.

3.8.2 Plotting and Briefing Branch

Results of the ground survey were plotted for display at various locations.

3.8.3 Logistics Branch

Sixty-six project personnel were issued anti-contamination clothing for the Coulomb "A" detonation. Full radex clothing was issued to all personnel desiring entry into the contaminated area to insure adequate protection against alpha contamination.

Anti-contamination clothing, materials and supplies were issued as follow:

Item	Number
Coveralls	66
Shoe Covers (pairs)	93
Respiratory Devices	73

3.9 Hood (July 4 through July 13, 1957)

Hood was an experimental device suspended from a balloon anchored 1500 feet above Area 9 in Yucca Flat. The device was detonated at 0440 hours on July 5, 1957. The mushroom cloud rose to approximately 49,000 feet MSL. Its base was at 30,000 feet and it moved in a north-northeasterly direction from Yucca Flat at approximately 20 knots.

3.9.1 General Monitoring Branch

Monitoring participation involved initial helicopter surveys and surveys by ground vehicles. The aerial survey team was delayed in its survey by heavy dust which obscured ground points. As a result, the initial aerial survey of the shot area was performed at H / 6 hours. The mid-time of this survey was 1043 hours. Results were as follows:

Intensity r/hr	Location	Altitude feet
3	North Winch Site	25
1.5	Southeast Winch Site	25
1.5	West Winch Site	25
20	Ground Zero	500

Aerial re-surveys in Area 9 were made as follows:

D / 1 (mid-time 0927 hours)

Intensity r/hr	Location	Altitude feet
1	North Winch Site	25
0.5	Southeast Winch Site	25
0.5	West Winch Site	25
40	Ground Zero	25

D / 2 days (mid-time 0846 hours)

Intensity r/hr	Location	Altitude feet
20	Ground Zero	25

The teams for the initial ground survey of the shot area left at 0445 hours. The mid-time of this survey was 0536 hours. The teams were unable to obtain readings leading to a closure of the 10 mr/hr contour line to the north and east of ground zero because of rough terrain and numerous brush fires ignited by the detonation. Another ground survey team left at 0500 to determine intensities in Areas 1, 2, 3, 4, 7, and 12.

At 0522 hours on D-day, a Rad-Safe check station located at Nevada Grid Coordinates N 861.5, E 682.0 was established on the Mercury Highway to control access into contaminated areas. This check station was maintained daily from 0630 hours to approximately 1930 hours until the area was declared non-radex at 1900 hours July 13.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
July 55	D / 1/4	1052
July 6	D / 1	0613
July 7	D / 2	0818
July 8	D / 3	0658
July 9	D / 4	0901
July 10	D / 5	0702
July 12	D / 7	0643
July 13	D / 8	0730

Data were obtained on the D / 1/4 re-survey which led to closure of the 10 mr/hr line. At this time the 10 mr/hr, 100 mr/hr, and 1 r/hr lines were marked with warning signs.

3.9.2 Plotting and Briefing Branch

Results of the surveys were plotted for display at various locations. (Figures No. 3.9.1 through 3.9.5)

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
D-day	30	8	126
D / 1	13	8	94
D / 2	7	5	20
D / 3	15	8	54
D / 4	11	9	40
D / 5	8	5	28
D / 6	17	6	61
D / 7	22	8	81
D / 8	36	9	115
Totals	159	66	619

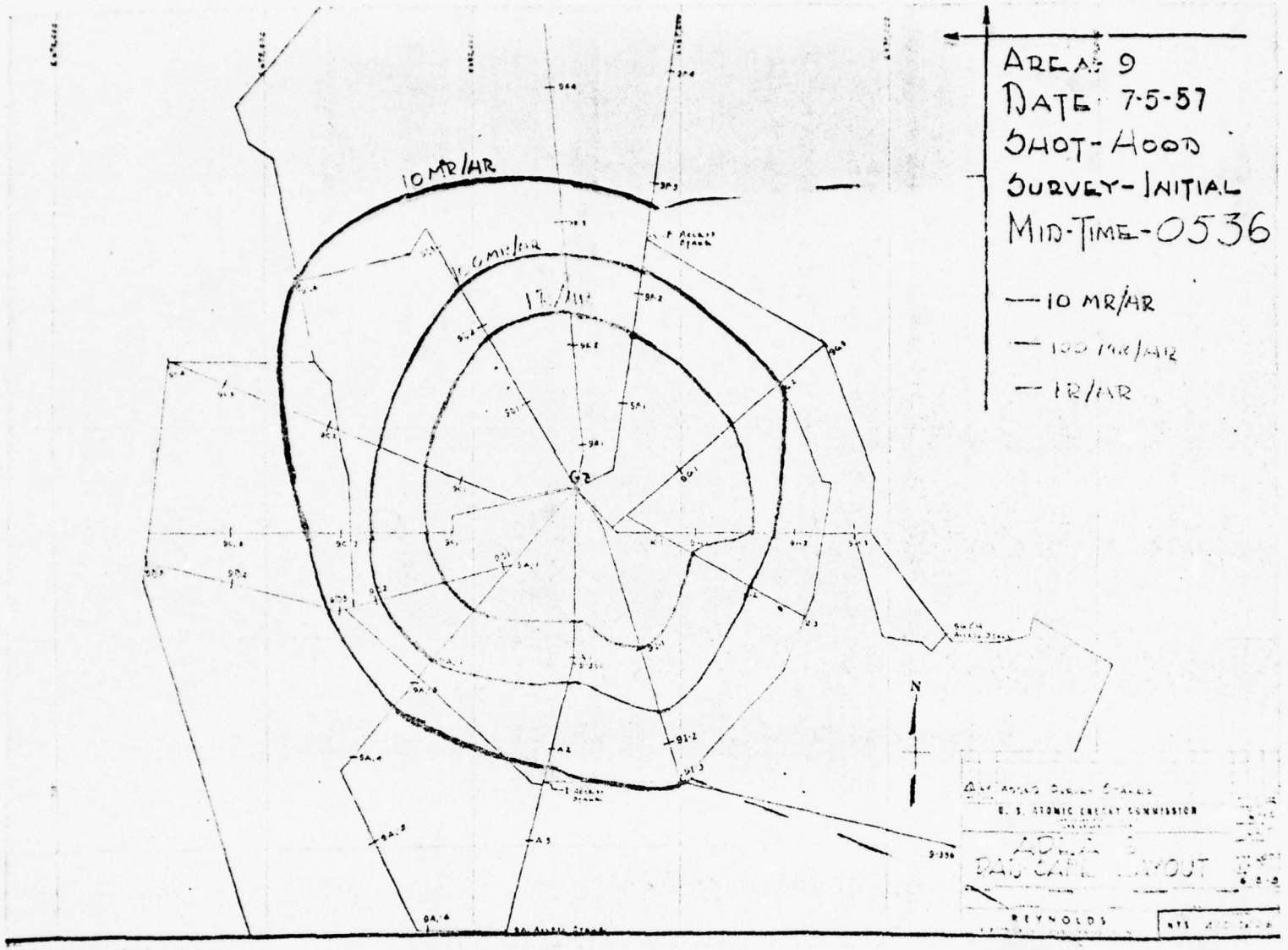

Figure 3.9.1 Hood, Initial

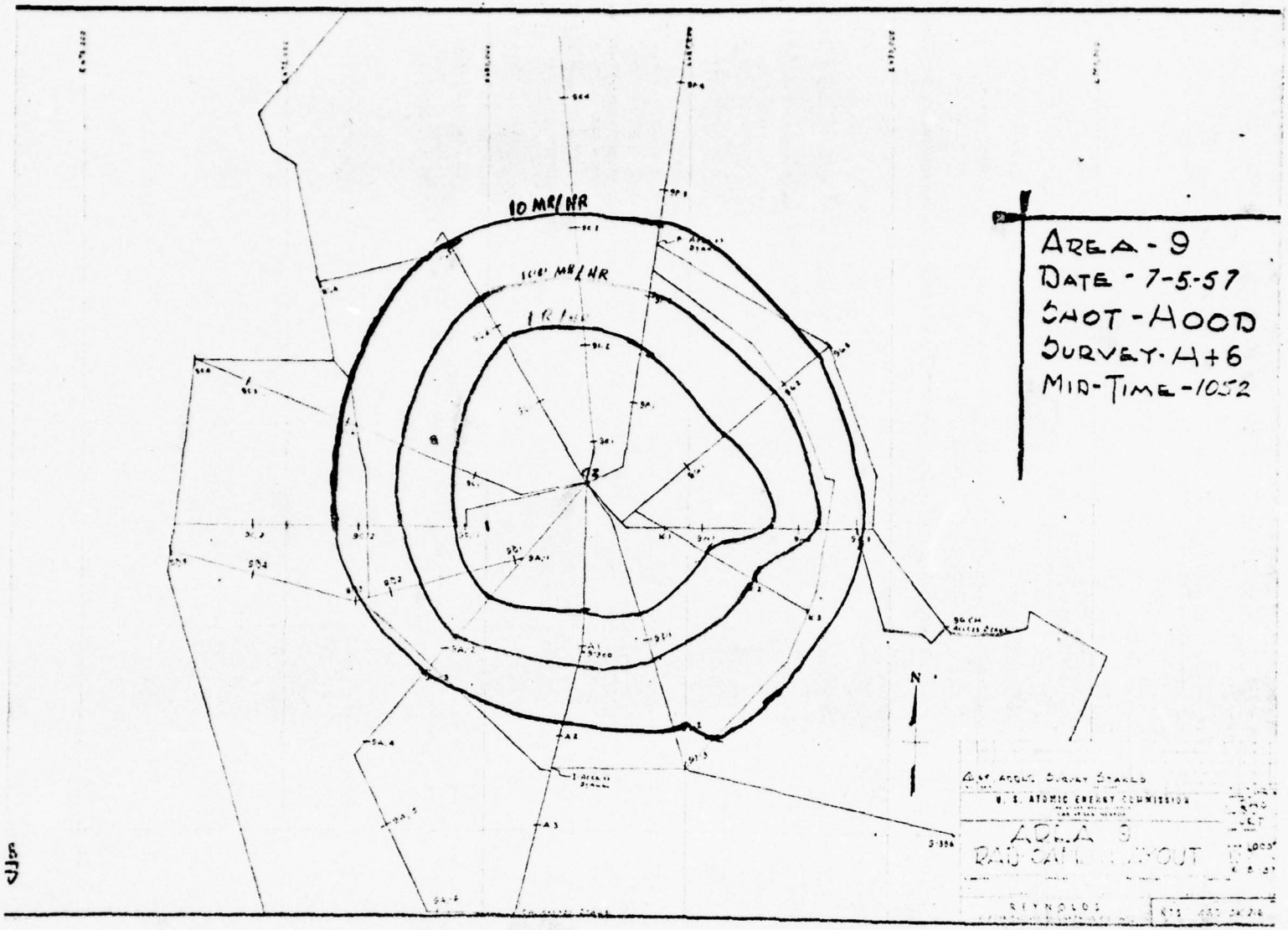

Figure 3.9.2 Hood, H + 6

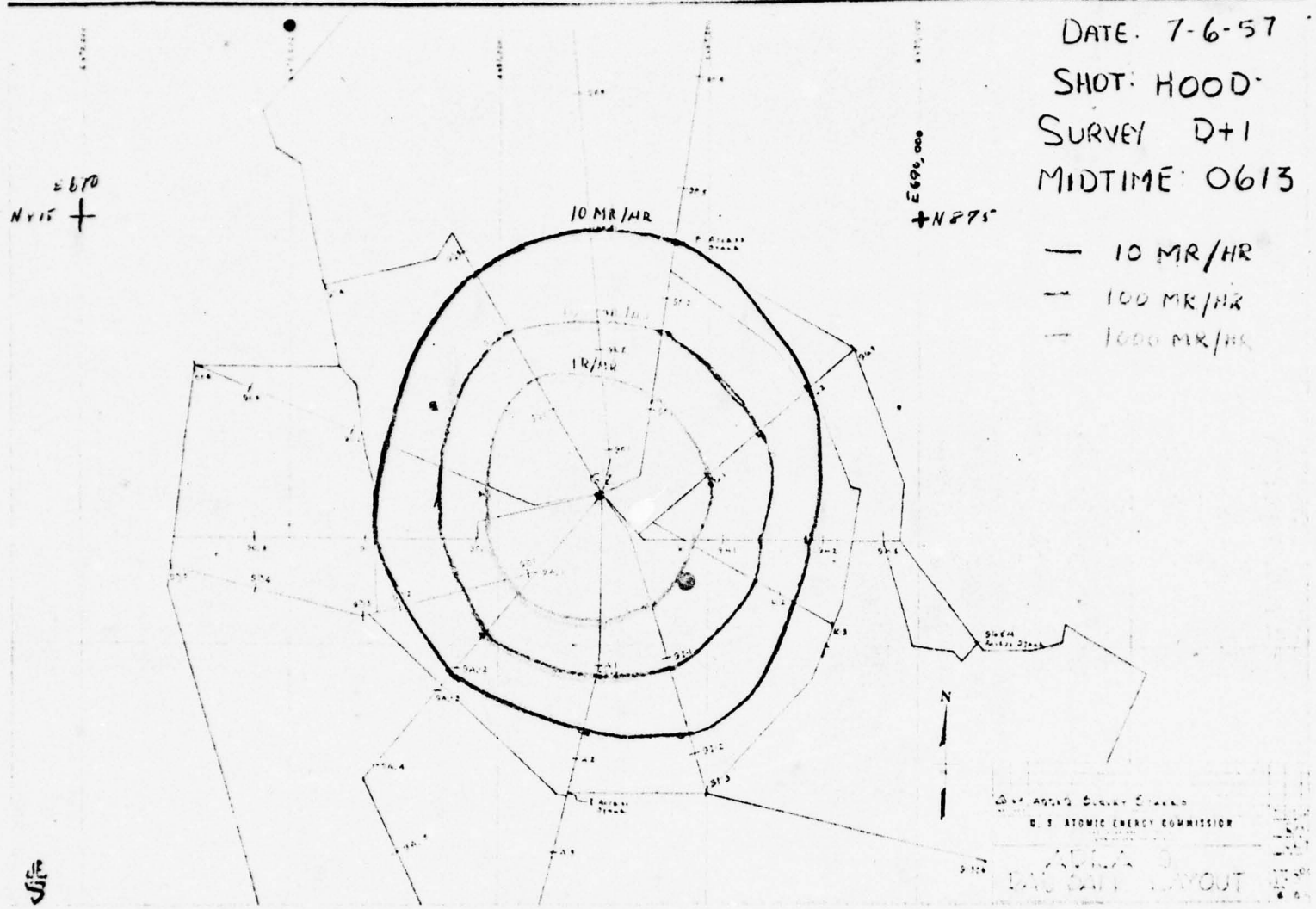

Figure 3.9.3 Hood, D + 1

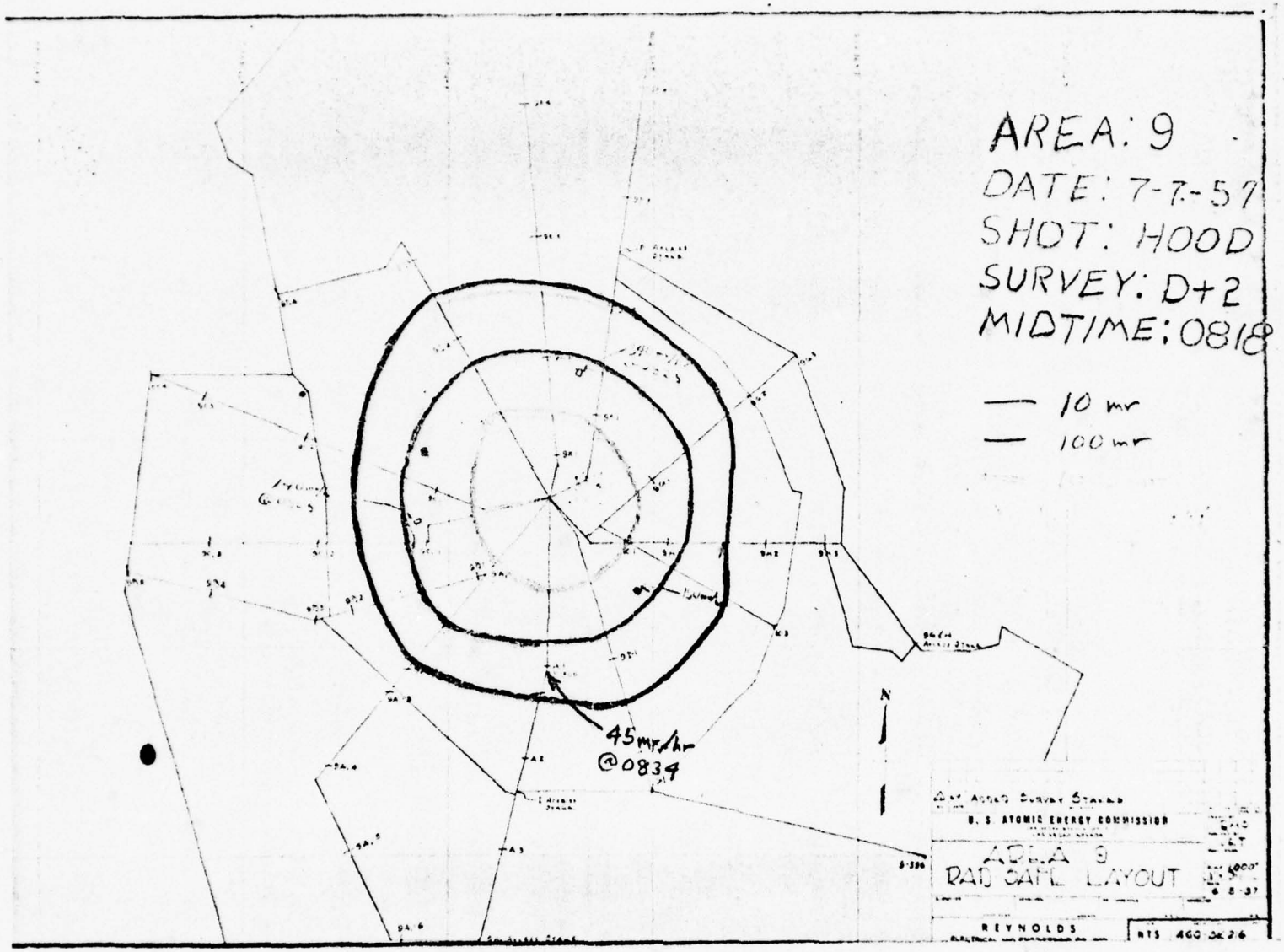

Figure 3.9.4 Hood, D + 2

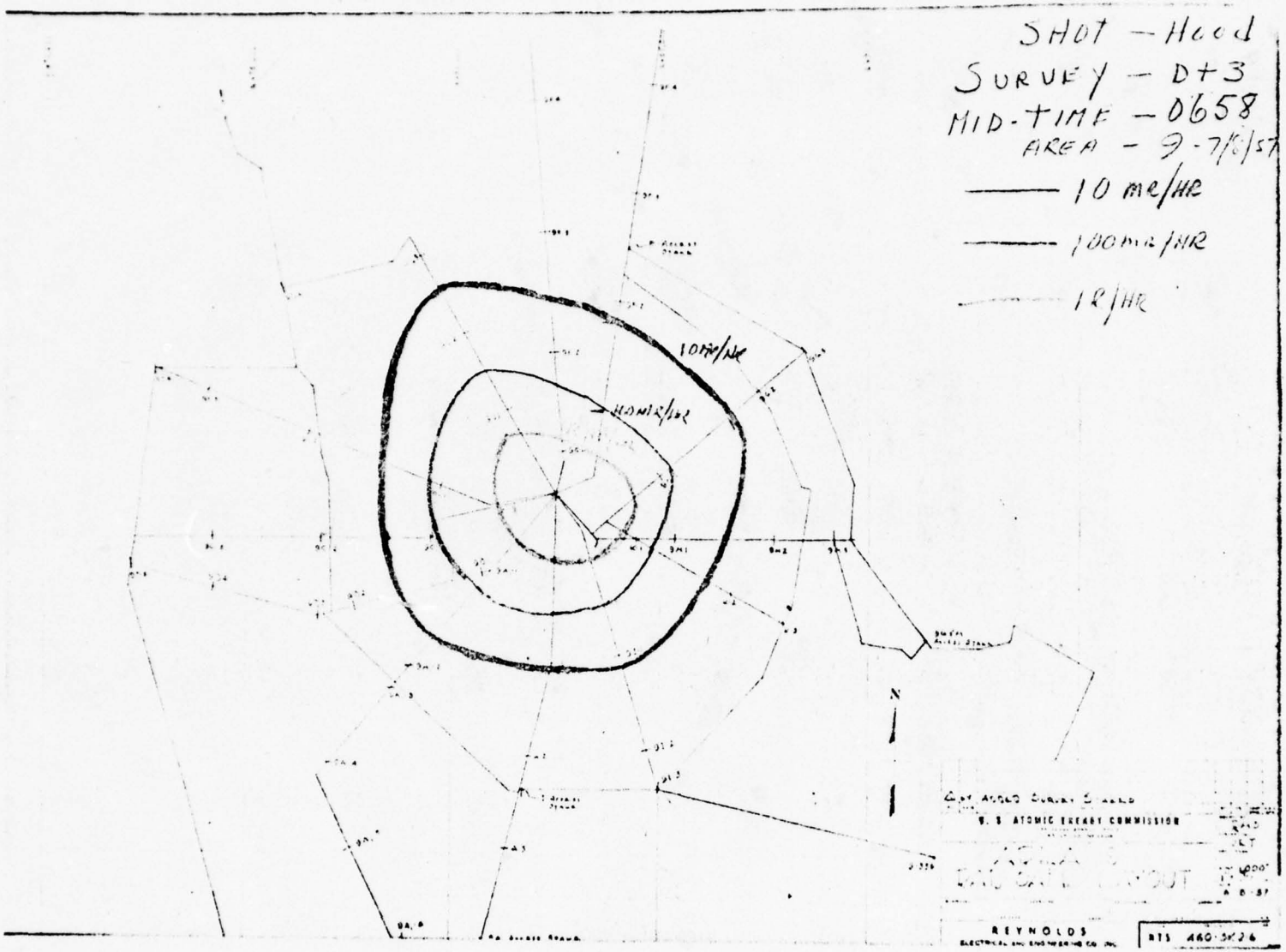

Figure 3.9.5 Hood, D + 3

3.9.3 Decontamination Branch

The following items were decontaminated at the CP-6:

Equipment	Number
Vehicles	29
Pressure Gauges	20
Electrical Devices	5
Brock House	1
Telephone	1

3.9.4 Special Assignments Branch

The following radioactive material was monitored and cleared for release from the Nevada Test Site:

Material	No. of Boxes	Agency
Scientific Instruments	1	Project 8.3
Raripactor Filters	1	Sandia Corp.
Soil	1	Project 2.3
Instruments	1	Project 6.2

The following sources were received on the Nevada Test Site:

Source	Intensity	Owner	User
Cs^{137}	5 curies	REECO	Inst. Repair
Ra^{226}	10 millicuries	UCLA*	Program 37, CETG

* University of California at Los Angeles

No significant radiation levels were encountered on the highway between the CP-2 and Mercury after the detonation.

Air-borne Radioactivity (D-day Averages):

Air Samples:

Location	Long-Lived Alpha d/m per M^3
Warehouse 6	Background
CP-2	Background
Area 2	Background
Gate 385	Background
Area 13	Background

Fallout Trays:

Location	Long-Lived Alpha d/m per ft^2
Warehouse 6	Background

Location	Long-Lived Alpha d/m per ft^2
Well 5	Background
CP-2	Background
Area 2	50
Gate 385	20
Area 13	Background
Shot Area	50

No increase in radioactivity was noted in well and drinking water samples.

Radiation surveys in "clean working and living areas" in Mercury and the CP Area were negative.

Exposures indicated from film badges placed prior to the shot and collected at H / 120 hours were as follows:

Location	Exposure mr
Gate 385	35
Area 13	3

The following samples were analyzed in the laboratory:

Type	Number
Air Samples	115
Nasal Swabs	69
Surface Swipes	699
Fallout Trays	113
Water Samples	13
Total	1009

3.9.5 Training Branch

A basic Rad-Safe training course, attended by five Rad-Safe Division personnel, was completed on July 6.

A two-hour re-orientation lecture and tour of the CP-2 was given to six DOD personnel on July 9.

A one-hour lecture and tour of the CP-2 was given to 9 Canadian military personnel on July 10.

The three-day Rad-Safe training course was given to 14 EG&G, DOD, and REECO personnel on July 11.

A Rad-Safe lecture was given to 45 FCDA personnel on July 13.

3.9.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
July 4	36	213
July 5	94	418
July 6	33	132
July 7	13	66
July 8	80	321
July 9	54	198
July 10	83	107
July 11	125	237
July 12	136	247
July 13	184	262
Totals	839	2201

Dosimeters:

Date	Issued	Received
July 4	0	0
July 5	165	150
July 6	45	60
July 7	32	32
July 8	30	25
July 9	28	33
July 10	27	14
July 11	32	45
July 12	2	2
July 13	44	0
Totals	405	361

3.9.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 983 people as follows:

Item	Number
Coveralls	606
Shoe Covers (pairs)	819
Respirators	552
Other Items	2037

The laundry processed 5397 pieces of anti-contamination items.

3.10 Diablo (July 14 through July 22, 1957)

Diablo was a device fired from a 500-foot tower in Area 2b at Yucca Flat. The device was detonated at 0430 hours on July 15, 1957. The mushroom cloud, moving at a very low speed from the point of detonation, deposited heavy fallout across the northeasterly quadrant of Yucca Flat.

3.10.1 General Monitoring Branch

The aerial survey team completed its initial survey at a mid-time of 0645 hours. The intensity on a pad 5500 feet north of Area 2c ground zero was 2 r/hr. Aerial re-surveys were made on D / 1, D / 2, and D / 3 days.

Ground survey teams for the initial radiological survey of the shot area left at 0435 hours. Repeated attempts to obtain data leading to a closure on the 10 mr/hr, 100 mr/hr, and 1 r/hr lines were unsuccessful, as a zone of contamination extended away from ground zero into impassable terrain to the north and east.

Another ground survey team surveyed the other shot areas at the same time. The result of this survey, with a mid-time of 0700 hours, was as follows:

Intensity r/hr	Location	Area
2.6	Ground Zero	10
3.0	1 Mile North of Decontamination Shack	13
2.0	Decontamination Shack	13
2.0	Gate 385	Yucca Flat
Background	Well 3	Yucca Flat
As Posted Pre-Shot	Ground Zero	4
As Posted Pre-Shot	Ground Zero	3
As Posted Pre-Shot	Ground Zero	7
As Posted Pre-Shot	Ground Zero	9

On D / 1 day a Rad-Safe check station was established at the intersection of the Area 2 access road and the Mercury Highway.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
July 15	D / 1/4	1118
July 16	D / 1	0645
July 17	D / 2	0652
July 18	D / 3	0642
July 19	D / 4	0755
July 20	D / 5	0722
July 21	D / 6	0715
July 22	D / 7	0630
July 23	D / 8	0603

Re-surveys from D / 1 to D / 6 days were delayed by early rocket firing in forward areas. The D / 7 re-survey was delayed by the John detonation over Area 10.

There were 9 monitors provided for projects and REECO support.

3.10.2 Plotting and Briefing Branch

Results of the surveys were plotted for display at various locations. (Figures No. 3.10.1 through 3.10.6).

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
July 15	30	10	80
July 16	10	9	30
July 17	11	6	51
July 18	11	7	26
July 19	11	4	34
July 20	13	6	23
July 21	4	5	11
July 22	20	5	55
July 23	31	8	172
Totals	141	60	482

3.10.3 Decontamination Branch

The following items were decontaminated at the CP-6:

Equipment	Number
Vehicles	127

The following items were processed at a field decontamination station established at the BJY:

Equipment	Number
Road Graders	4
Bulldozers	1
Tournapulls	2

3.10.4 Special Assignments Branch

The following radioactive material was monitored and cleared for release from the Nevada Test Site:

Material	No. of Boxes	Agency
Soil Samples	3	Project 32.3
Wood Samples	1	Project 32.1
Ra^{226} Source	1	REECO Rad-Safe

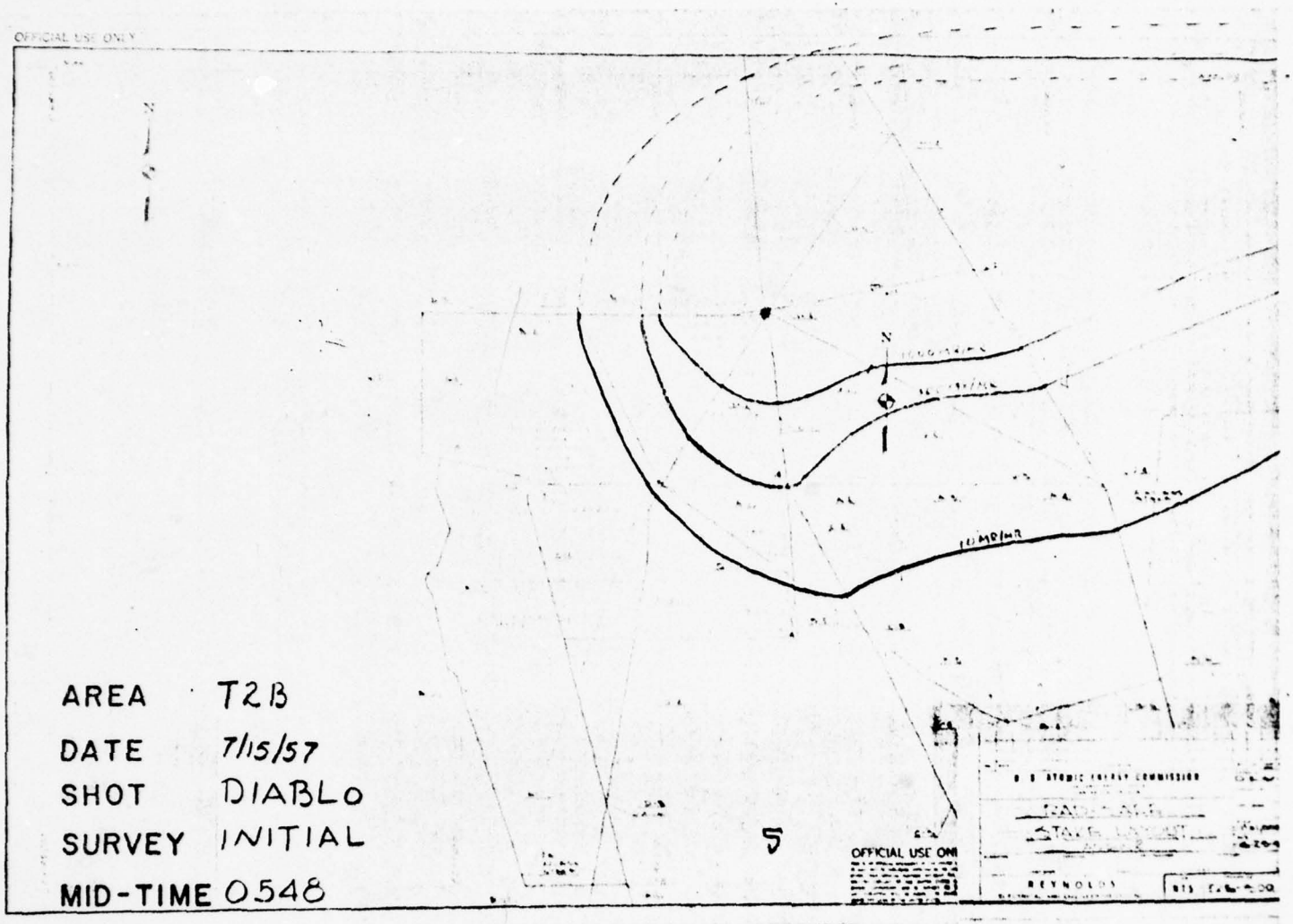

Figure 3.10.1 Diablo, Initial

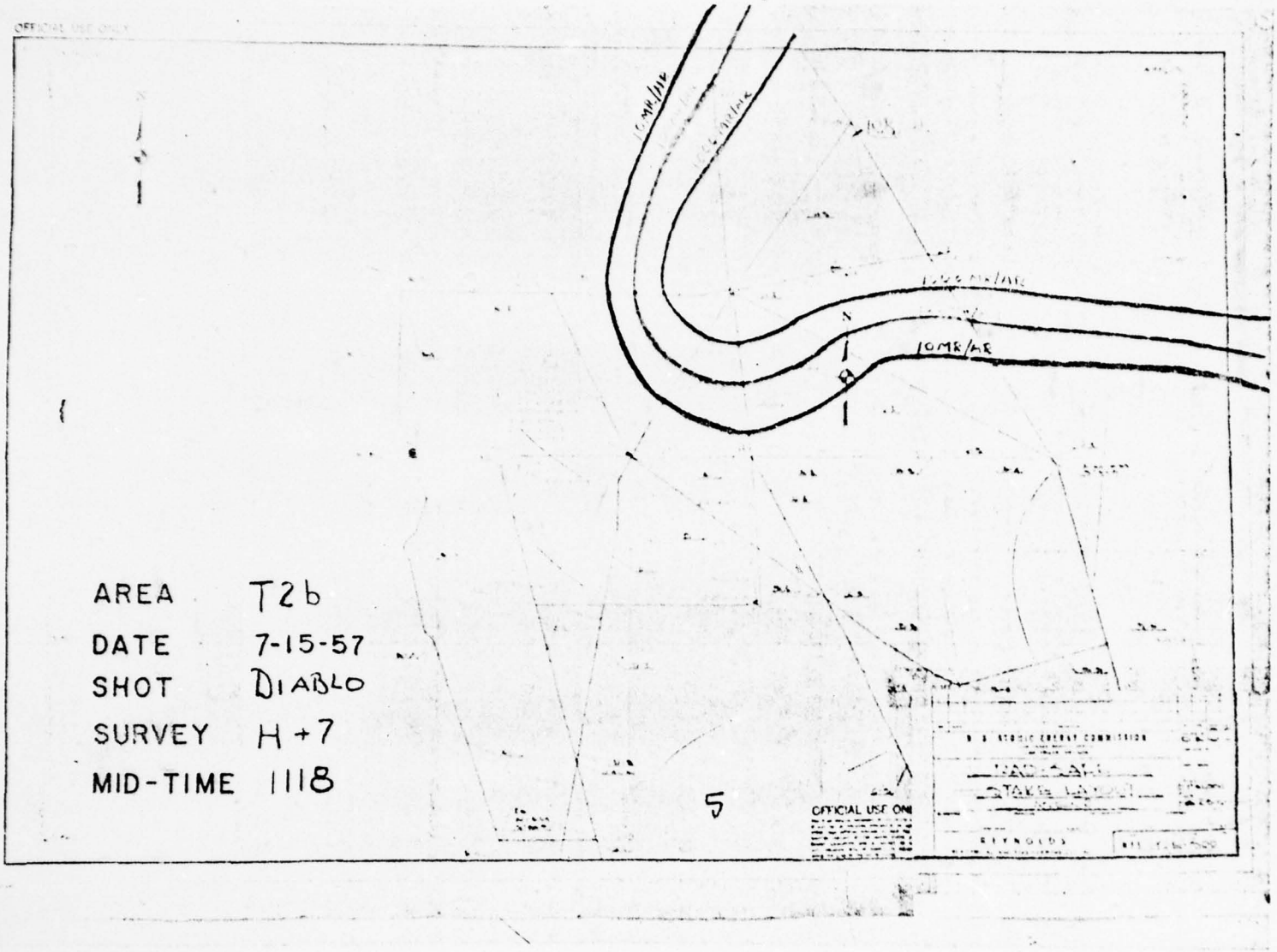

Figure 3.10.2 Diablo, H + 7

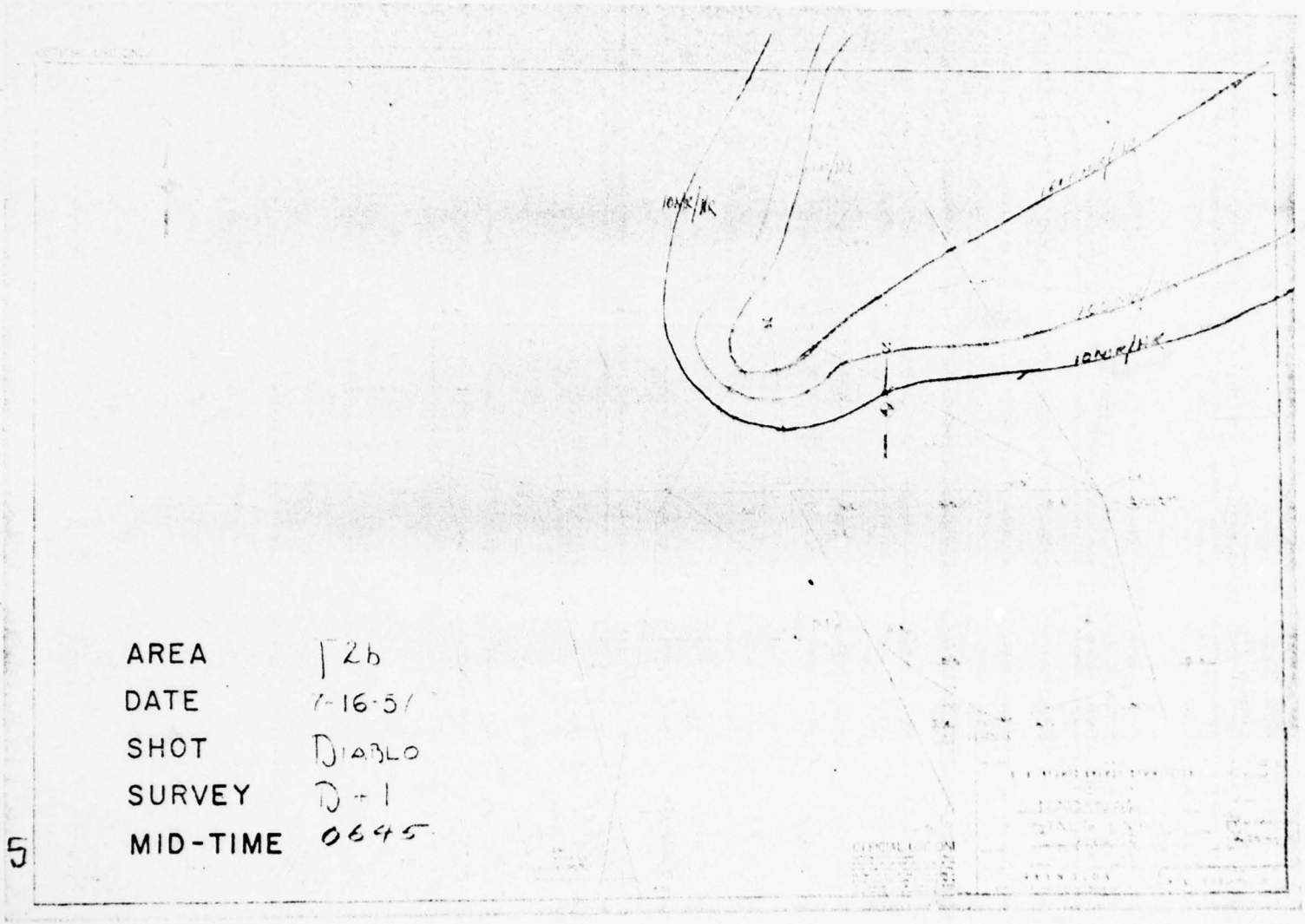

Figure 3.10.3 Diablo, D + 1

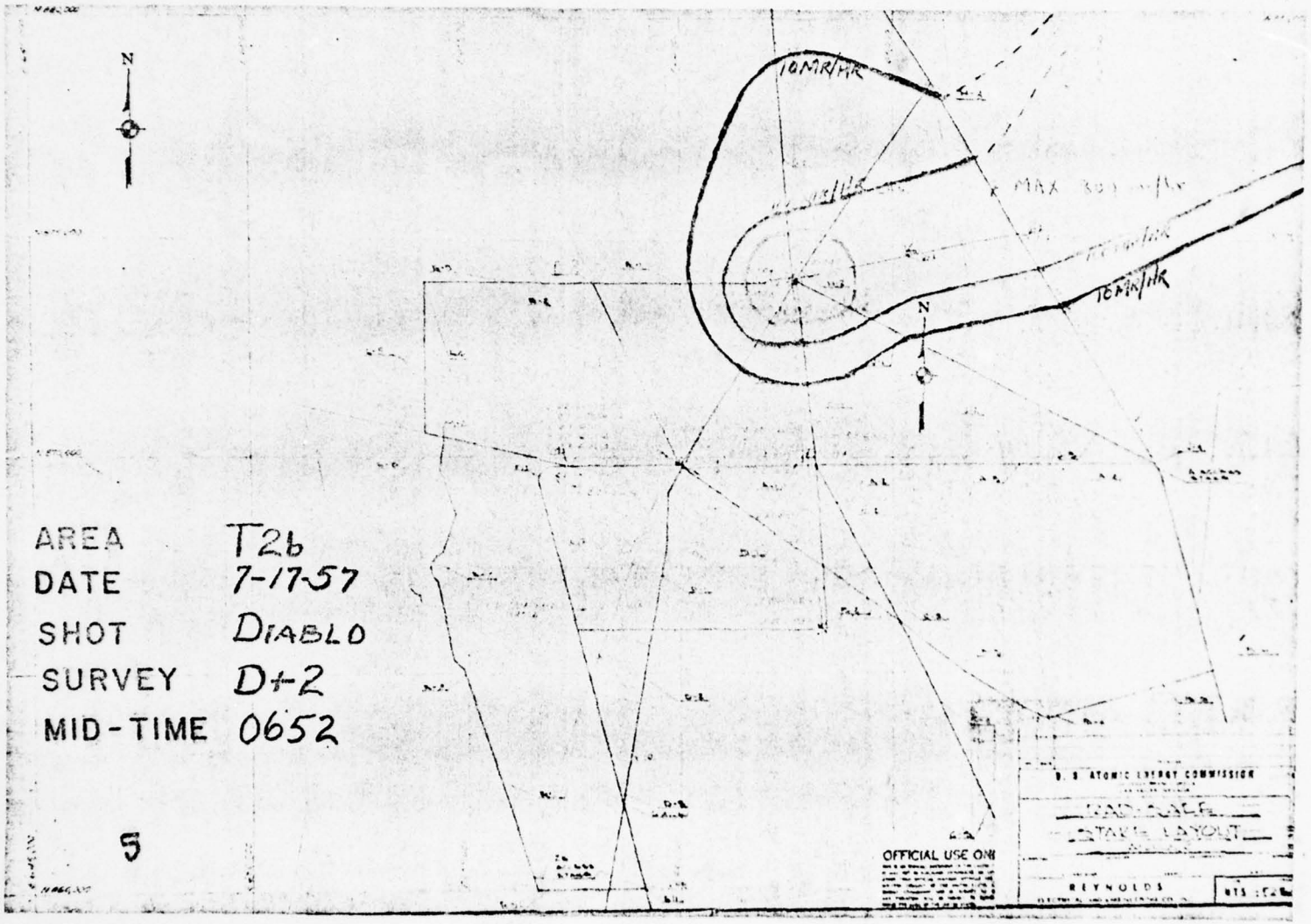

Figure 3.10.4 Diablo, D+2

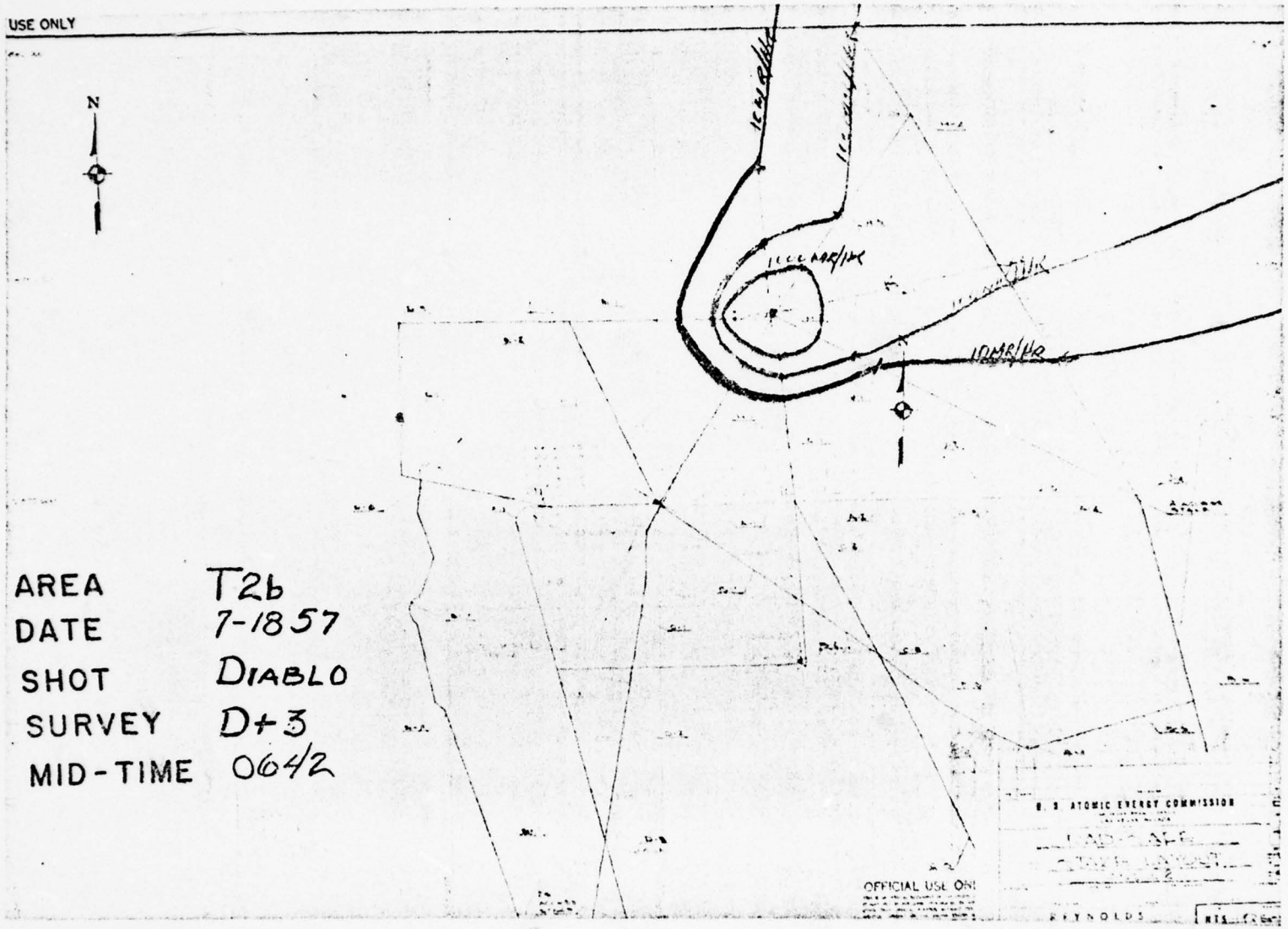

Figure 3.10.5 Diablo, D + 3

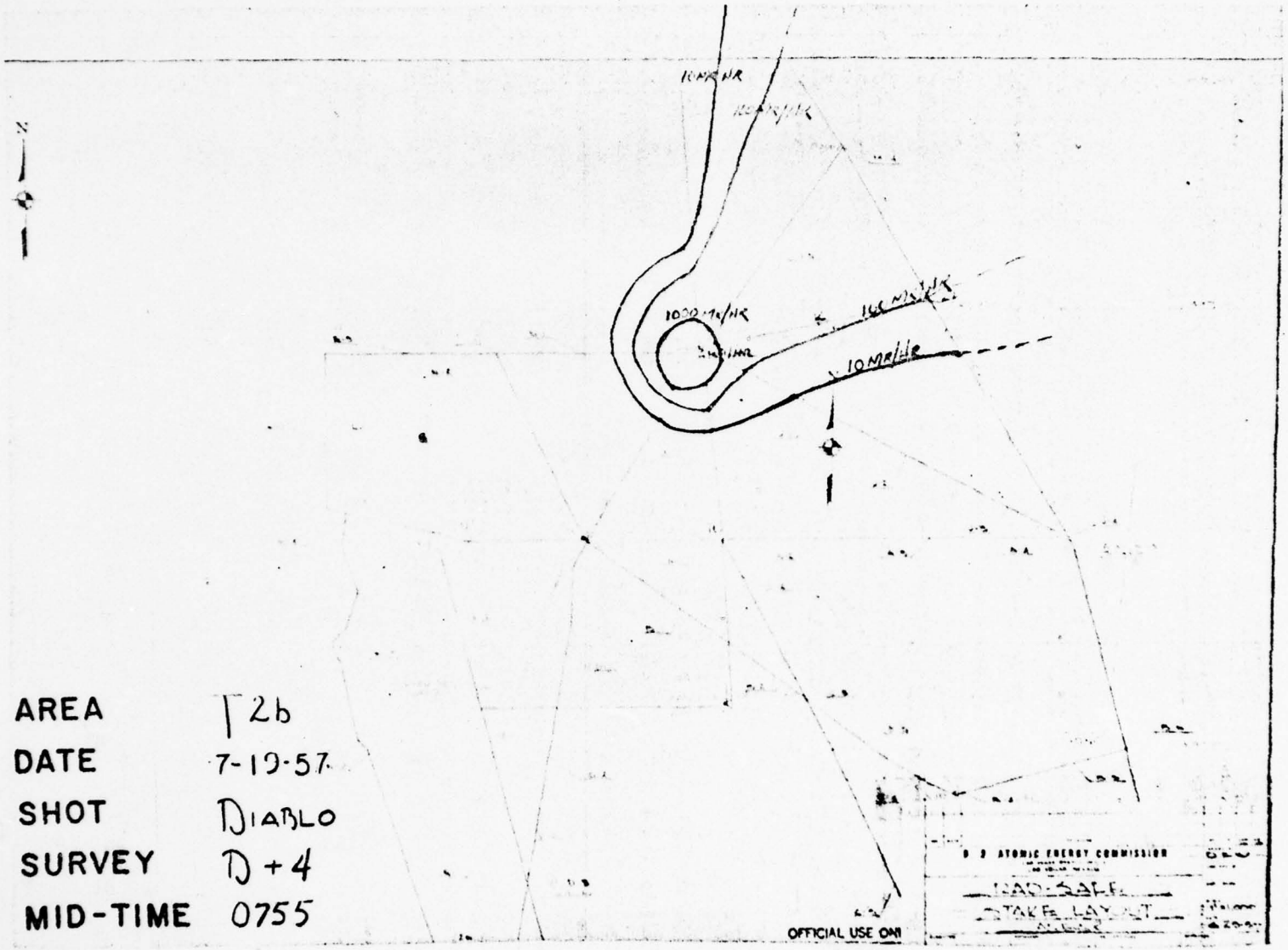

Figure 3.10.6 Diablo, D + 4

No significant radiation levels were encountered on the highway between the CP-2 and Mercury after the detonation.

Air-borne Radioactivity (D-day Averages):

Air Samples:

Location	Long-Lived Alpha d/m per M^3
Warehouse 6	Background
CP-2	0.1
Gate 385	Background
Area 13	0.1

Fallout Trays:

Location	Long-Lived Alpha d/m per ft^2
Warehouse 6	Background
Well 5	Background
CP-2	Background
Area 2	34
Gate 395	130
Area 13	2100
Shot Area	24

No increase in radioactivity was noted in well and drinking water samples.

Radiation surveys in "clean working and living areas" in Mercury and the CP Area were negative.

The following samples were analyzed in the laboratory:

Type	Number
Air Samples	188
Nasal Swabs	63
Surface Swipes	290
Fallout Trays	105
Water Samples	6
Total	652

3.10.5 Training Branch

A one-hour lecture was given to 75 military and civilian observers on the morning of D-day in the official observer area between the hours of 0330 and 0430.

Navy and Air Force Medical Officers were given a two-hour orientation lecture and tour at the CP-2 on July 18.

A lecture was given prior to the John detonation to a group of approximately 150 official military observers at the official observer area at 0630 hours on July 19.

3.10.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
July 14	84	361
July 15	458	437
July 16	334	559
July 17	251	202
July 18	594	412
July 19	425	385
July 20	152	245
July 21	103	70
July 22	165	122
July 23	146	255
Totals	2712	3048

Dosimeters:

Date	Issued	Received
July 14	12	12
July 15	110	80
July 16	80	80
July 17	49	49
July 18	163	33
July 19	17	17
July 20	10	10
July 21	12	52
July 22	52	80
July 23	90	70
Totals	595	493

A summary report on personnel gamma radiation exposures from April 25 through July 20, 1957, was tabulated and distributed on July 22, 1957.

3.10.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 883 people as follows:

Item	Number
Coveralls	561
Shoe Covers (pairs)	611
Respirators	393
Other Items	2112

The laundry processed 5037 pieces of anti-contamination items.

3.11 John (July 19, 1957)

John, an air-to-air weapon, was fired at a point in space 18,000 feet MSL above Area 10 in Yucca Flat. The device was detonated at 0700 hours on July 19, 1957. The doughnut-shaped cloud rose to a maximum height of 40,000 feet MSL and moved in a north-northeasterly direction at about 30 knots.

3.11.1 General Monitoring Branch

The initial ground survey teams detected no increase in radiation levels within the Nevada Test Site.

3.11.2 Plotting and Briefing Branch

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
July 19	4	3	25

3.11.3 Training Branch

A pre-shot lecture was given to a group of 150 official military observers at 0630 hours in the official observer area.

3.11.4 Personnel Dosimetry Branch

A total of 82 dosimeters were issued to Nevada Test Site personnel.

3.11.5 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 41 people.

3.12 Kepler (July 23 through July 24, 1957)

Kepler was a device fired from a 500-foot tower in Area 4. The device was detonated at 0450 hours on July 24, 1957. The main mass of the cloud rose rapidly to 25,000 feet MSL; the upper layers were blown slowly to the east-northeast; and the lower layers drifted west-northwest. The lower portion formed a U-shape and moved slowly toward the northwest.

3.12.1 General Monitoring Branch

The aerial survey team departed at 0735 hours. Results of this survey were as follows:

Intensity mr/hr	Location	Altitude feet	Time hours
Background	BJY	50	0740
100	from N 875.0, E 667.5 to N 885.0, E 666.0	50	0743

Intensity mr/hr	Location	Altitude feet	Time hours
10	N 885.0, E 665.0	25	0745
Background	North to South across Canyon at entrance to Area 12	500	0748
50,000	Ground Zero	500	0750
700	4-300 Bunker	500	0756
3,000	4-380 Bunker	500	0759

The initial ground survey teams left at 0525 hours. Fallout was anticipated to the east of ground zero, but it was found to have made a large fan to the west. Mid-time on this survey was 0637 hours. No closure of the 10 mr/hr or the 1 r/hr lines was made.

The ground team for the survey of non-shot areas departed at 0530 hours.

The results of this survey were as follows:

Intensity mr/hr	Location	Time hours
25	Area 1 GZ	0554
Background	Area 2 GZ	0550
Background	Area 2a GZ	0555
As Posted	Area 2c GZ	0710
As Posted	Area 3 GZ	0532
Background	Area 3a GZ	0527
Background	Area 3b GZ	0530
Background	7-300 Bunker	0540
Background	Area 9 GZ	0632

At 0620 on D-day a Rad-Safe check station was established on the west fork of the BJY to control access into Area 4. The check station was moved at 0750 hours to the Area 4 main access road. The check station was operated at this site until 1830 hours, July 24, at which time it was withdrawn in preparation for the Owens detonation.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
July 24	D / 1/4	1124
July 25	D / 1	0937
July 26	D / 2	1057
July 27	D / 3	0636
July 29	D / 5	0810
July 31	D / 7	0608
Aug. 2	D / 9	0603

There were five monitors provided for projects and for REECO support.

3.12.2 Plotting and Briefing Branch

The results of the surveys were plotted for display at various locations. (Figures No. 3.12.1 through 3.12.6).

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
D-day	70	14	278

3.12.3 Decontamination Branch

The following items were decontaminated at the CP-6:

Equipment	Number
Vehicles	49
Vacuum Cleaner	1
Bulldozer	1

Contaminated waste material was disposed of in the burial pit in the vicinity of Kay Bunker in Frenchman Flat.

3.12.4 Special Assignments Branch

The following radioactive material was monitored and cleared for release from the Nevada Test Site:

Material	No. of Boxes	Agency
Soil Samples	2	Project 32.3, CETG

Air-borne Radioactivity (D-day Averages):

Air Samples:

Location	Long-Lived Alpha d/m per M^3
Warehouse 6	Background
CP-2	18
Area 2	Background
Area 13	Background

Fallout Trays:

Location	Long-Lived Alpha d/m per ft^2
Warehouse 6	185
Well 5	370

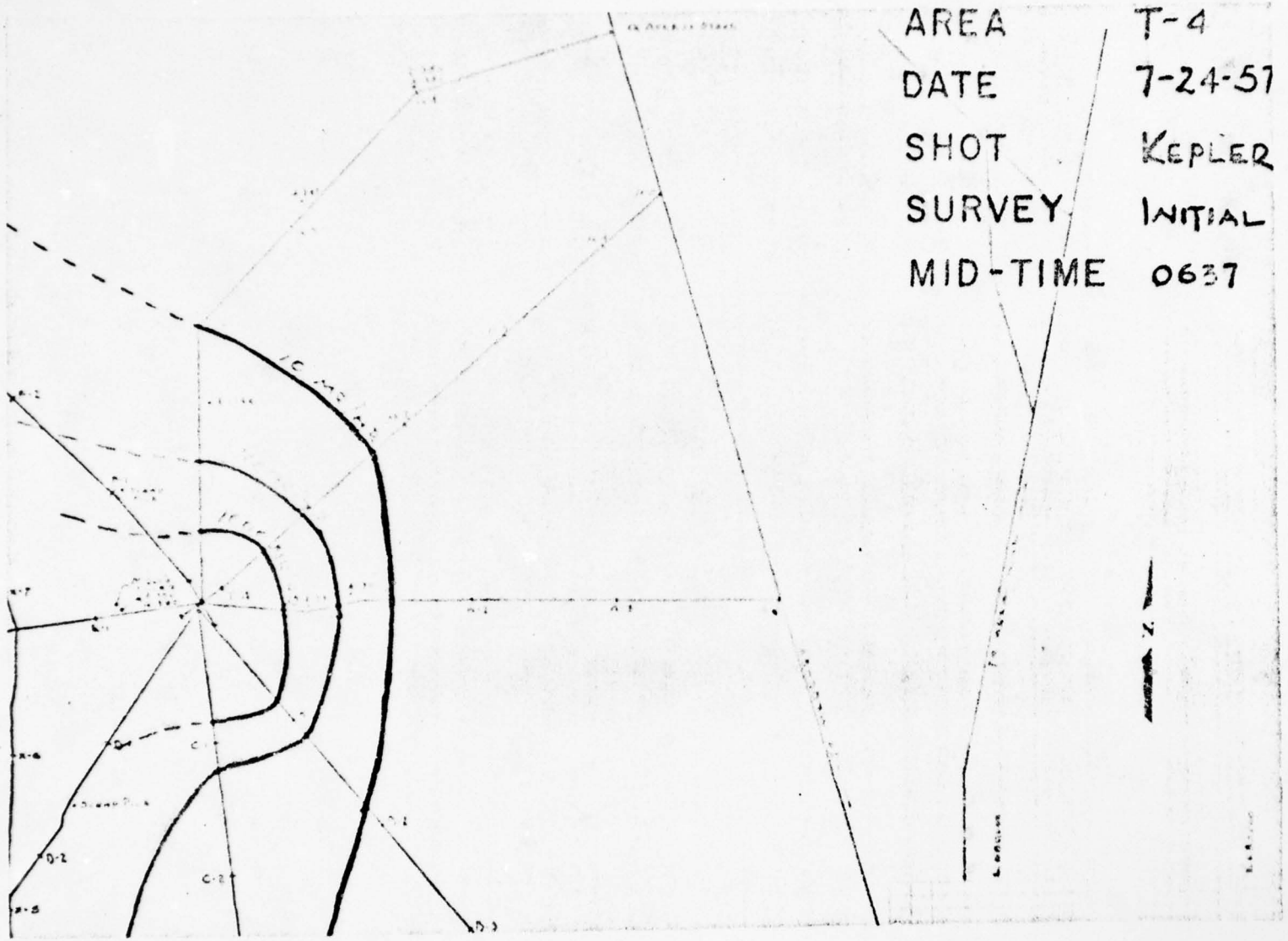

Figure 3.12.1 Kepler, Initial

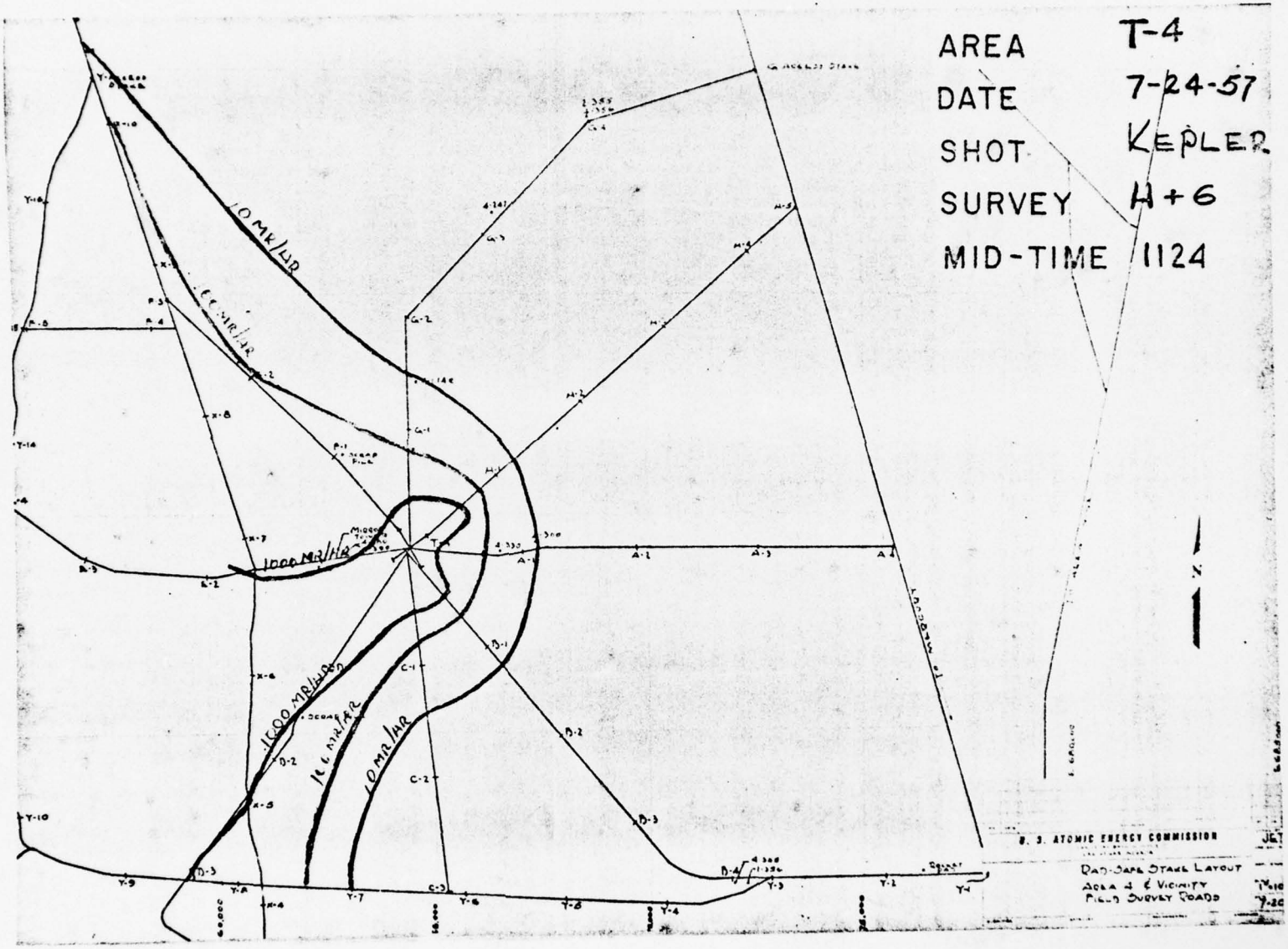

Figure 3.12.2 Kepler, H + 6

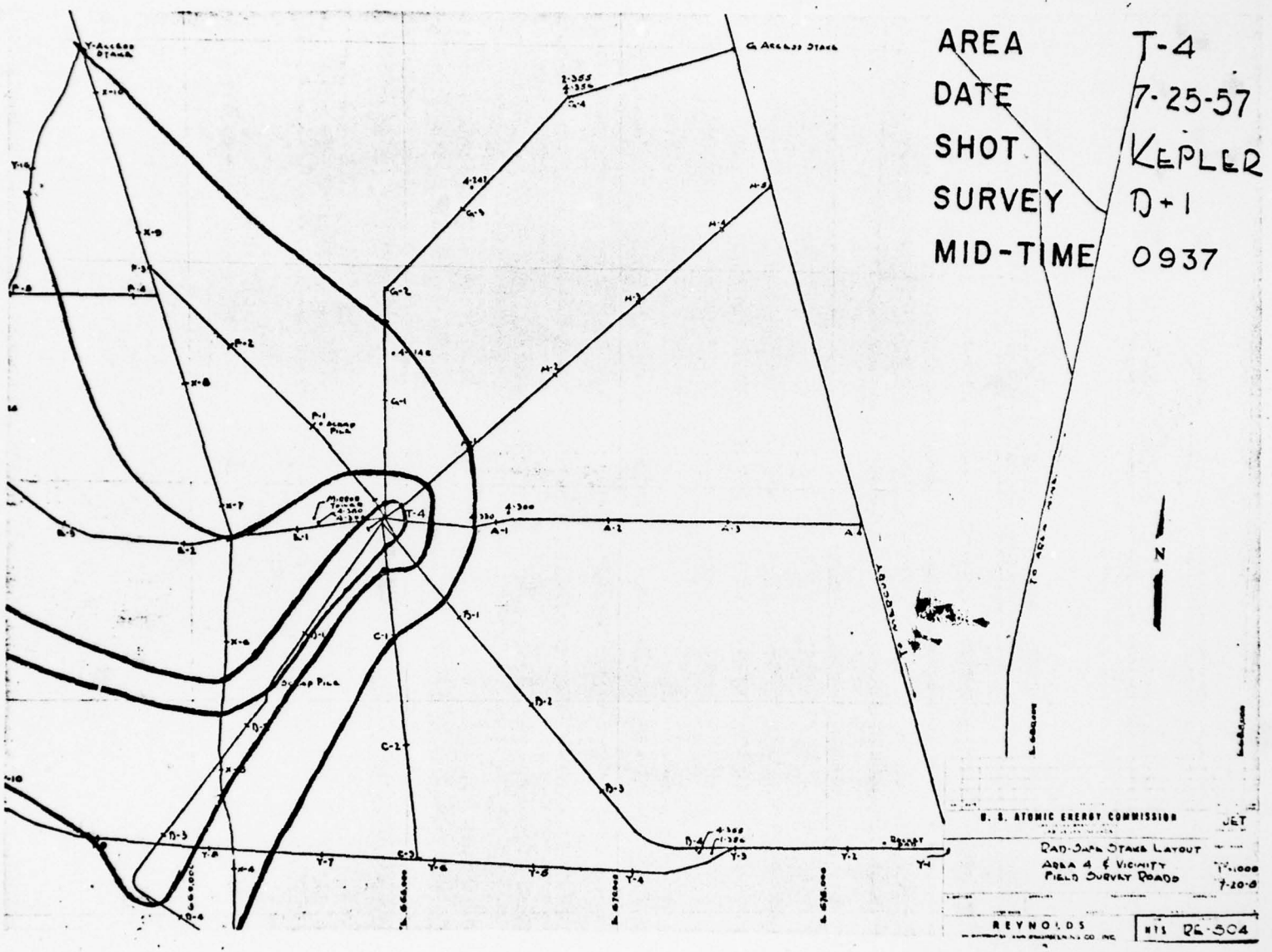

Figure 3.12.3 Kepler, D + 1

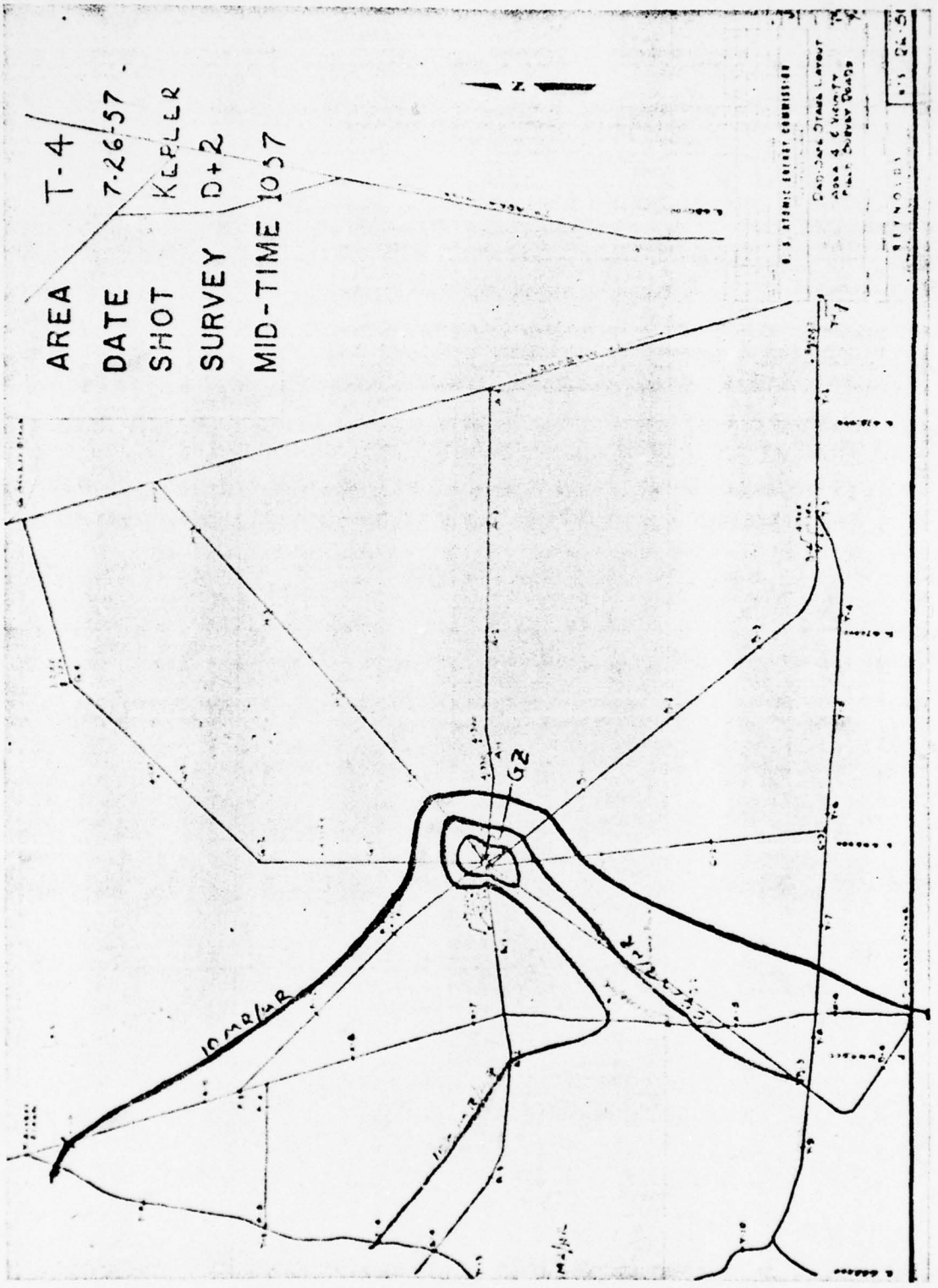

Figure 3.12.4 Kepler, D + 2

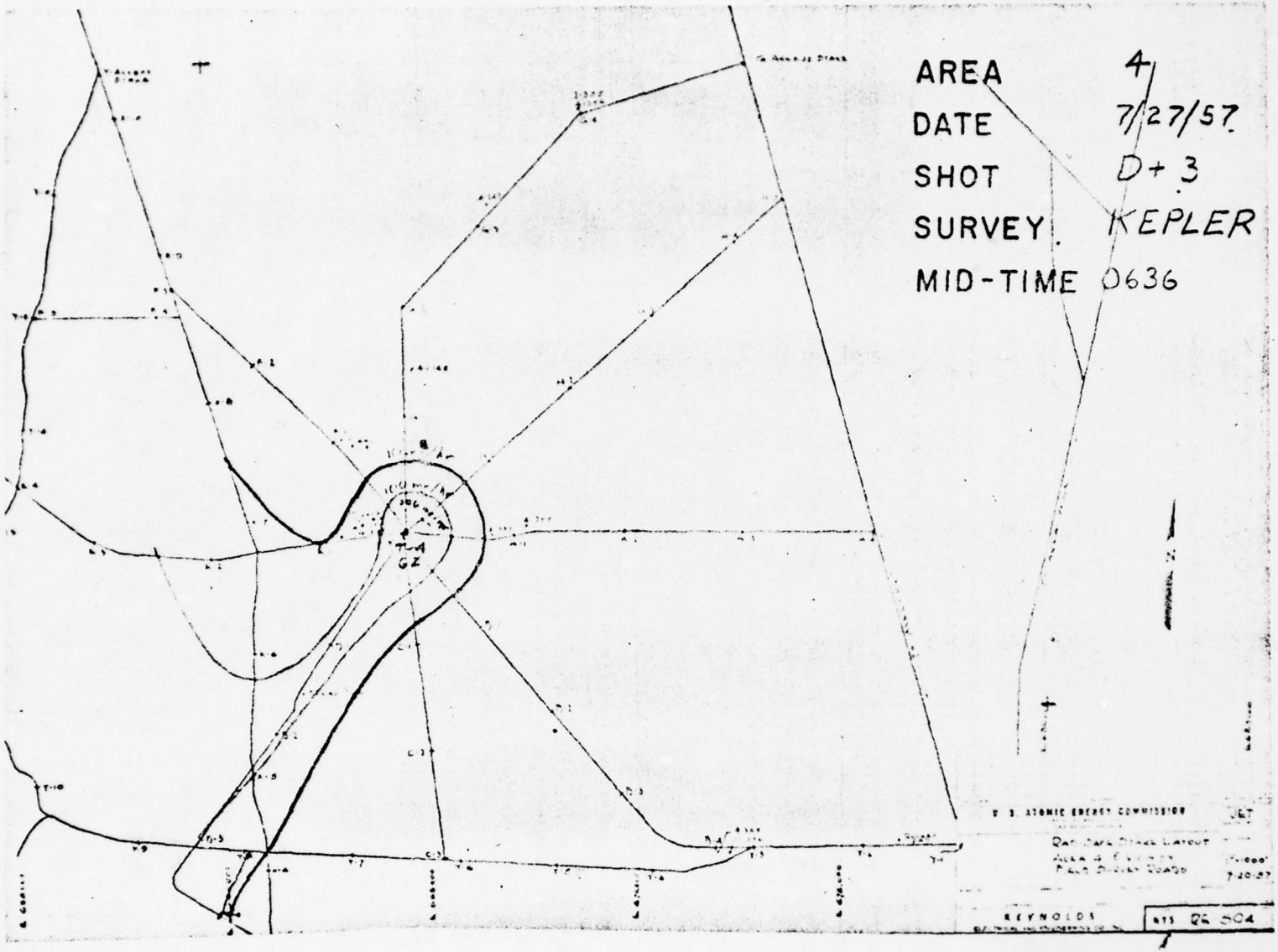

Figure 3.12.5 Kepler, D + 3

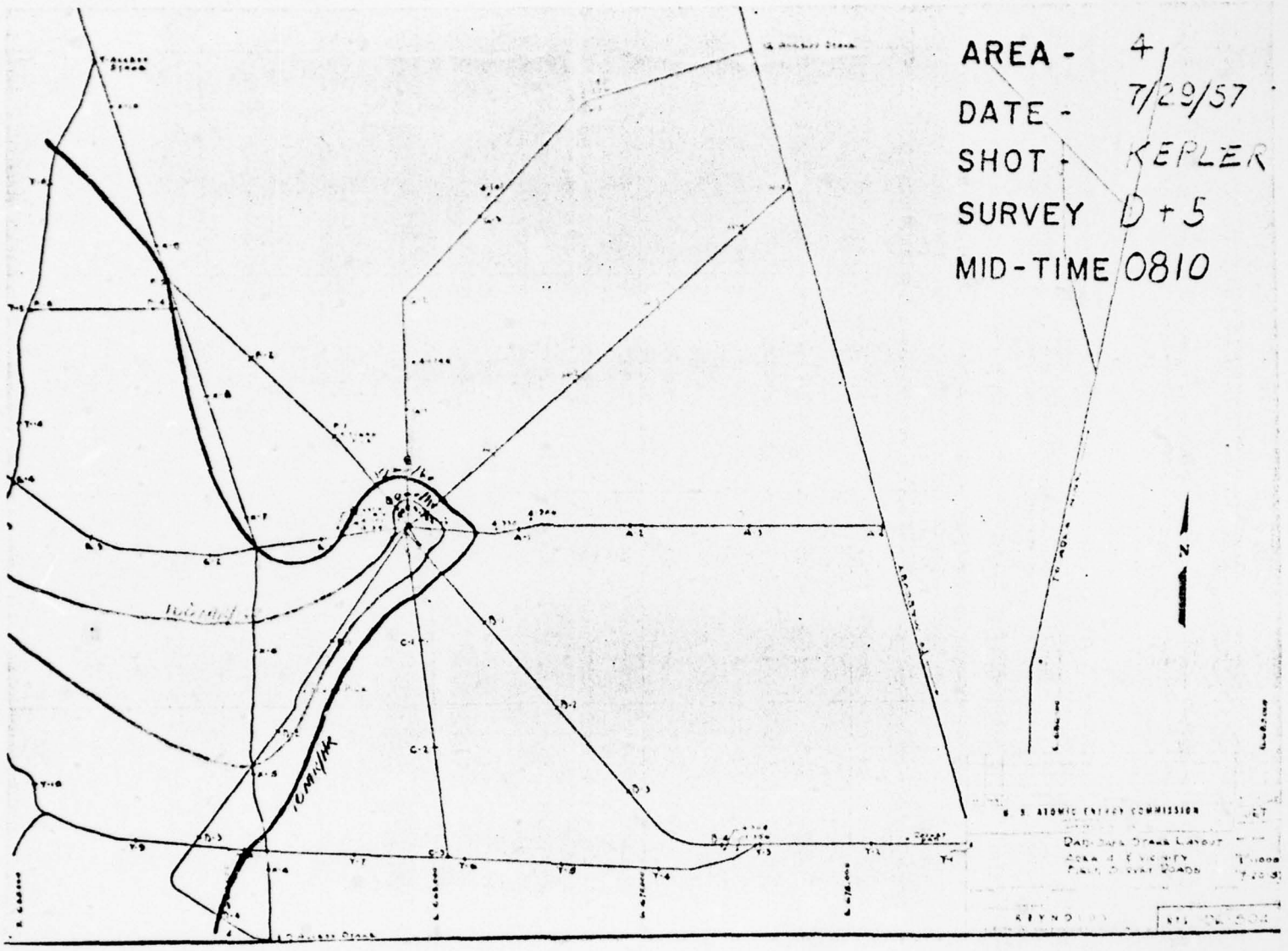

Figure 3.12.6 Kepler, D + 5

Location	Long-Lived Alpha d/m per ft^2
CP-2	118
Area 2	353
Gate 385	218
Area 13	319
Shot Area (Average)	7930

Radiation surveys in the "clean working and living areas" of Mercury and the CP Area were negative.

The following samples were analyzed in the laboratory:

Type	Number
Air Samples	54
Nasal Swabs	27
Surface Swipes	26
Total	107

3.12.5 Training Branch

Training Branch personnel acted as Rad-Safe monitors for a group of 60 FCDA personnel and Foreign Civil Defense Observers on a field trip into the forward area on July 23. The field trip was preceded by a lecture and tour of the CP-2.

3.12.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
July 23	146	255
July 24	76	509
Totals	222	764

Dosimeters:

Date	Issued	Received
July 23	90	70
July 24	167	60
Totals	257	130

3.12.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 460 people as follows:

Item	Number
Coveralls	351
Shoe Covers (pairs)	395
Respirators	75
Other Items	638

The laundry processed 1249 pieces of anti-contamination items.

3.13 Owens (July 24 through August 5, 1957)

Owens was an experimental device suspended from a plastic balloon anchored 500 feet above Area 9. The device was detonated at 0630 hours on July 25, 1957. The mushroom cloud rose to 35,000 feet MSL. The moisture provided by a light overcast caused an extensive ice cap to form over the top of the cloud as it surged upward in the middle stages of its ascent. The mushroom broke cleanly from the stem and moved very slowly in a north-northeasterly direction.

3.13.1 General Monitoring Branch

The results of the aerial survey of Area 9 indicated the following intensity at 0920 hours.

Intensity r/hr	Location	Altitude feet
23	Ground Zero	500

The helicopter crew made a D / 1 re-survey of Area 4 before returning to the helicopter pad.

Air re-surveys of Area 9 were made as follows:

Intensity r/hr	Location	Altitude feet	Time hours	Date
21	Ground Zero	200	0718	July 26
10	Ground Zero	300	0702	July 27
19	Ground Zero	100	0707	July 27
8	Ground Zero	25	0647	July 28

The initial ground radiological survey of the shot area departed at 0645 hours. The scheduled survey was performed at a mid-time of 0726 hours.

The ground team for the survey of non-shot areas departed at 0650 hours. Results of this survey, with a mid-time of 0725 hours, were as follows:

Intensity mr/hr	Location
Background	Well 3
Background	Area 3b GZ
Background	BJY

Intensity mr/hr	Location
Background	Area 3a GZ
Background	Area 3 GZ
Same as Posted July 3	Area 7 GZ
35	Area 2c GZ
Background	Area 1 GZ
Background	Tunnel Area (12)
14	Gate 385
Same as Posted July 23	Area 2
Same as Posted July 24	Area 4

A Rad-Safe check station was established and maintained at the intersection of Area 10 road and the Mercury Highway.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
July 25	D / 1/4	1233
July 26	D / 1	0756
July 27	D / 2	0637
July 28	D / 3	0745
July 30	D / 5	0610
Aug. 1	D / 7	0610
Aug. 4	D / 10	0600

There were two monitors provided for projects and for REECO support.

3.13.2 Plotting and Briefing Branch

Results of the surveys were plotted for display at various locations. (Figures No. 3.13.1 through 3.13.6)

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
July 25	93	15	274
July 26	110	15	357
July 27	88	17	228
July 28	34	10	99
July 29	75	17	232
July 30	61	15	176
July 31	62	14	238
Aug. 1	79	16	256
Aug. 2	85	15	255
Aug. 3	68	12	221
Aug. 4	63	13	218

Date	Scheduled Parties	Projects Involved	Personnel Involved
Aug. 5	88	12	202
Aug. 6	99	12	277
Totals	1005	183	3033

3.13.3 Decontamination Branch

The following items were decontaminated at the CP-6:

Equipment	Number
Vehicles	210
Pressure Gauges	30
Cranes	2
Metal Boxes	10
Concrete Ground Markers	12

The following items were decontaminated at the BJY Field Decontamination Station:

Equipment	Number
Winches	3
Transformers	6

3.13.4 Special Assignments Branch

The following radioactive material was monitored and cleared for release from the Nevada Test Site:

Material	No. of Boxes	Agency
Soil Samples	3	Project 73.1
Soil Samples	3	Sandia Corp.
Co^{60} Source	1	Project 2.5

Radiation signs and barricades were removed from the Evans Signal Laboratory calibration range near Gate 120.

The "clean area radiation surveillance" in Mercury disclosed an alpha contaminated spot of 250 c/m/55 cm^2 in the Tool Crib Building. Scotch tape strips removed the contamination. Radiation surveys of other "clean working and living areas" were negative.

Air-borne Radioactivity (D-day Averages):

Air Samples:

Location	Long-Lived Alpha d/m per M^3
Warehouse 6	Background

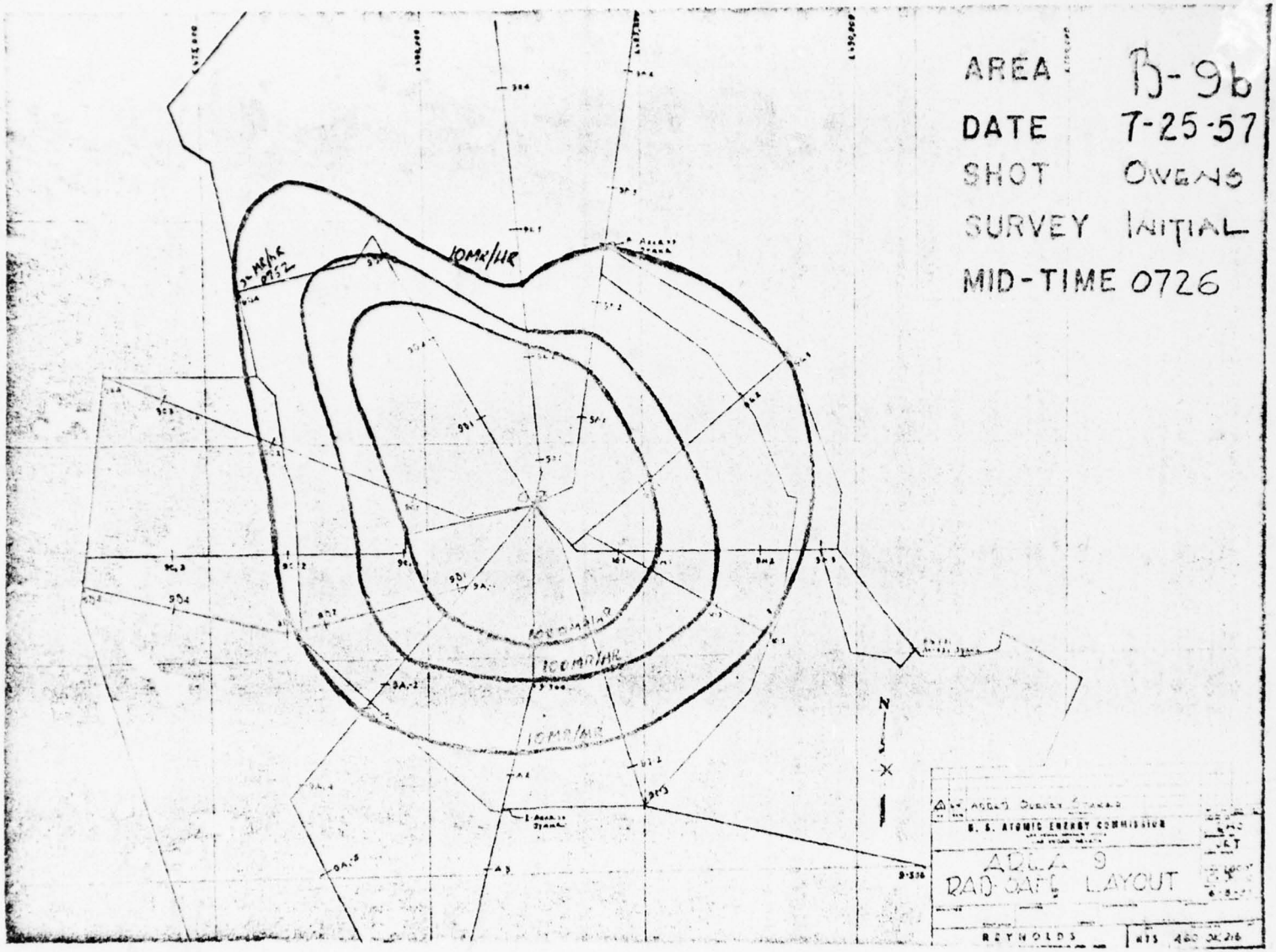

Figure 3.13.1 Owens, Initial

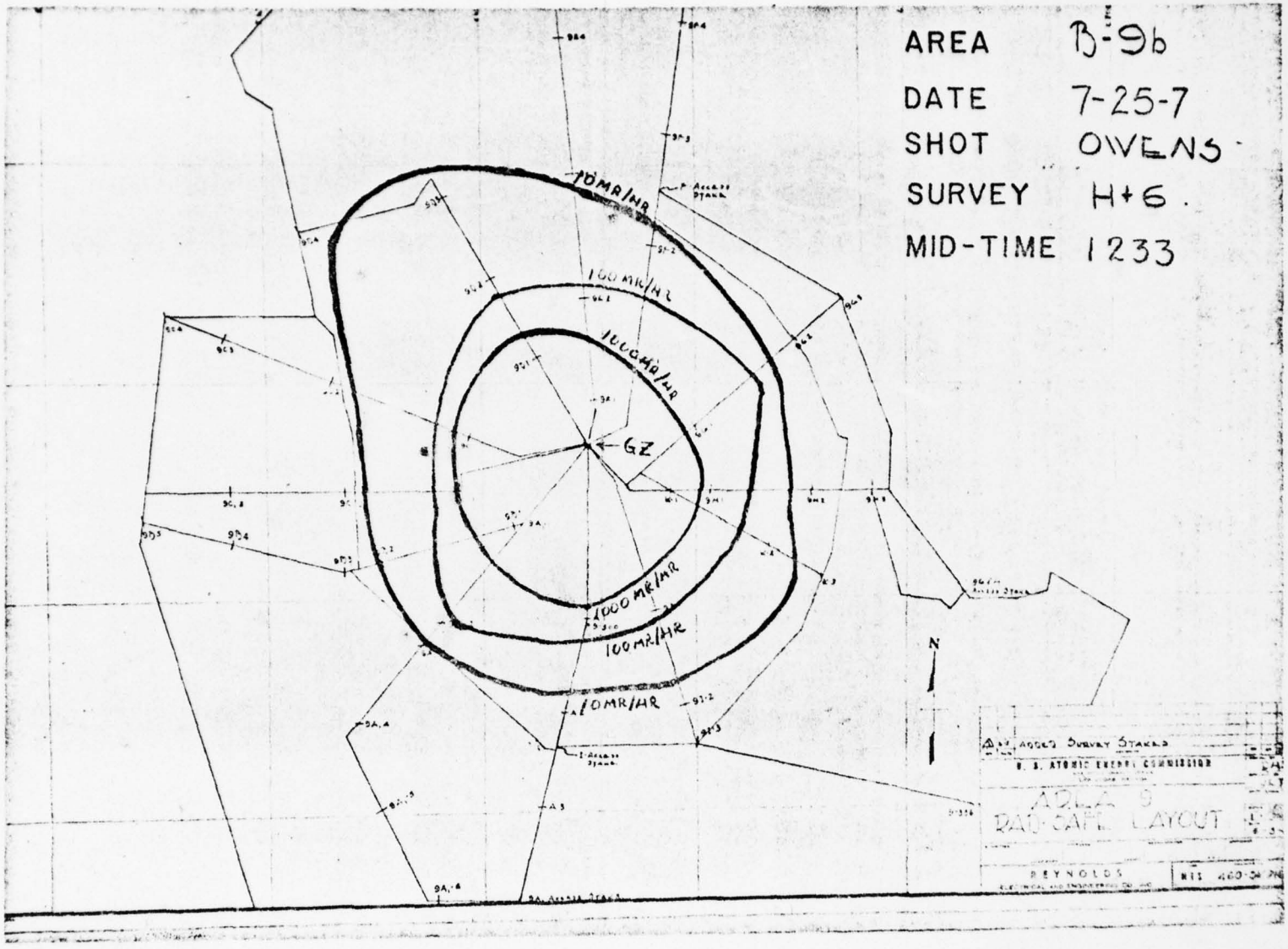

Figure 3.13.2 Owens, H + 6

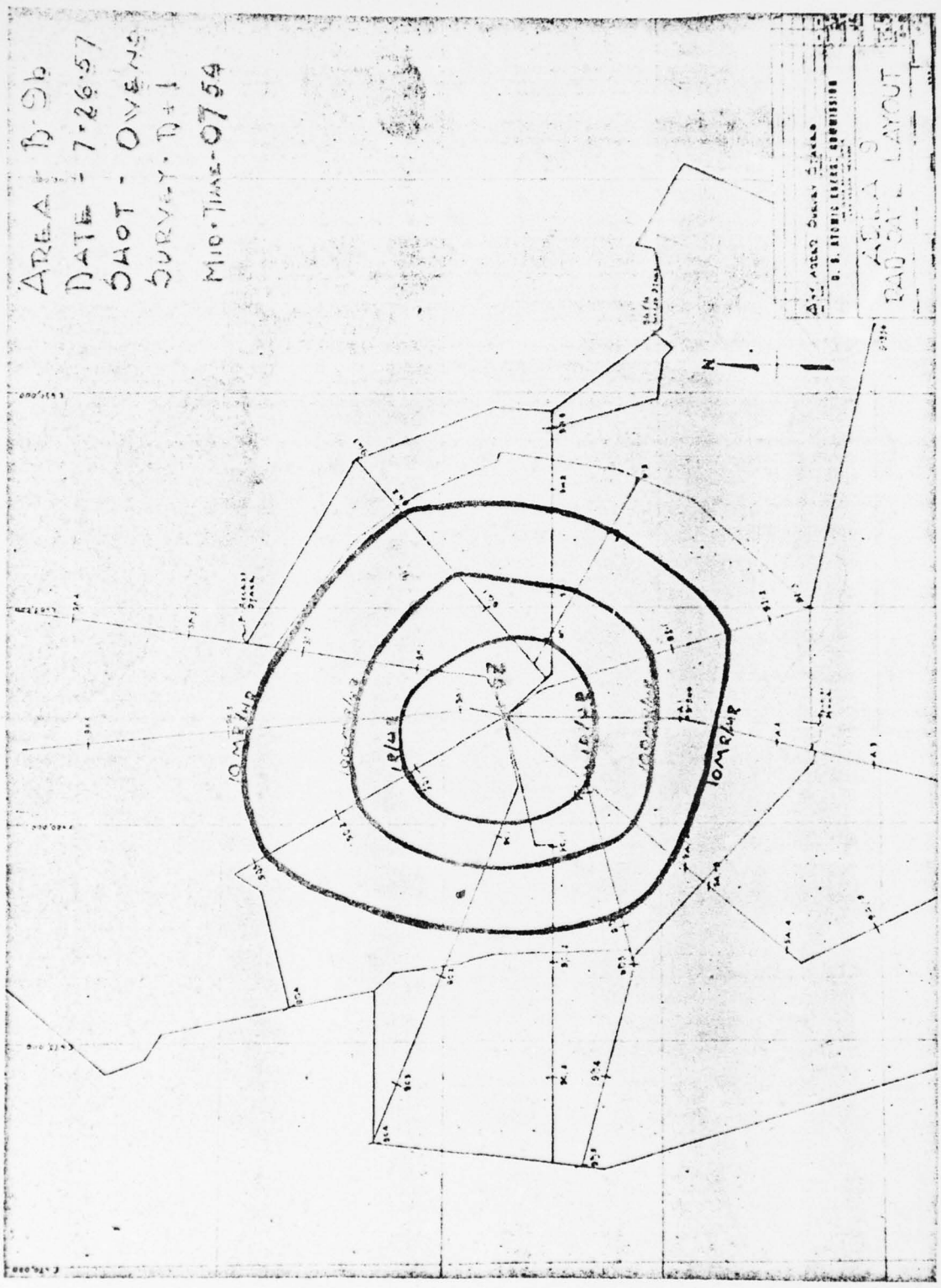

Figure 3.13.3 Owens, D + 1

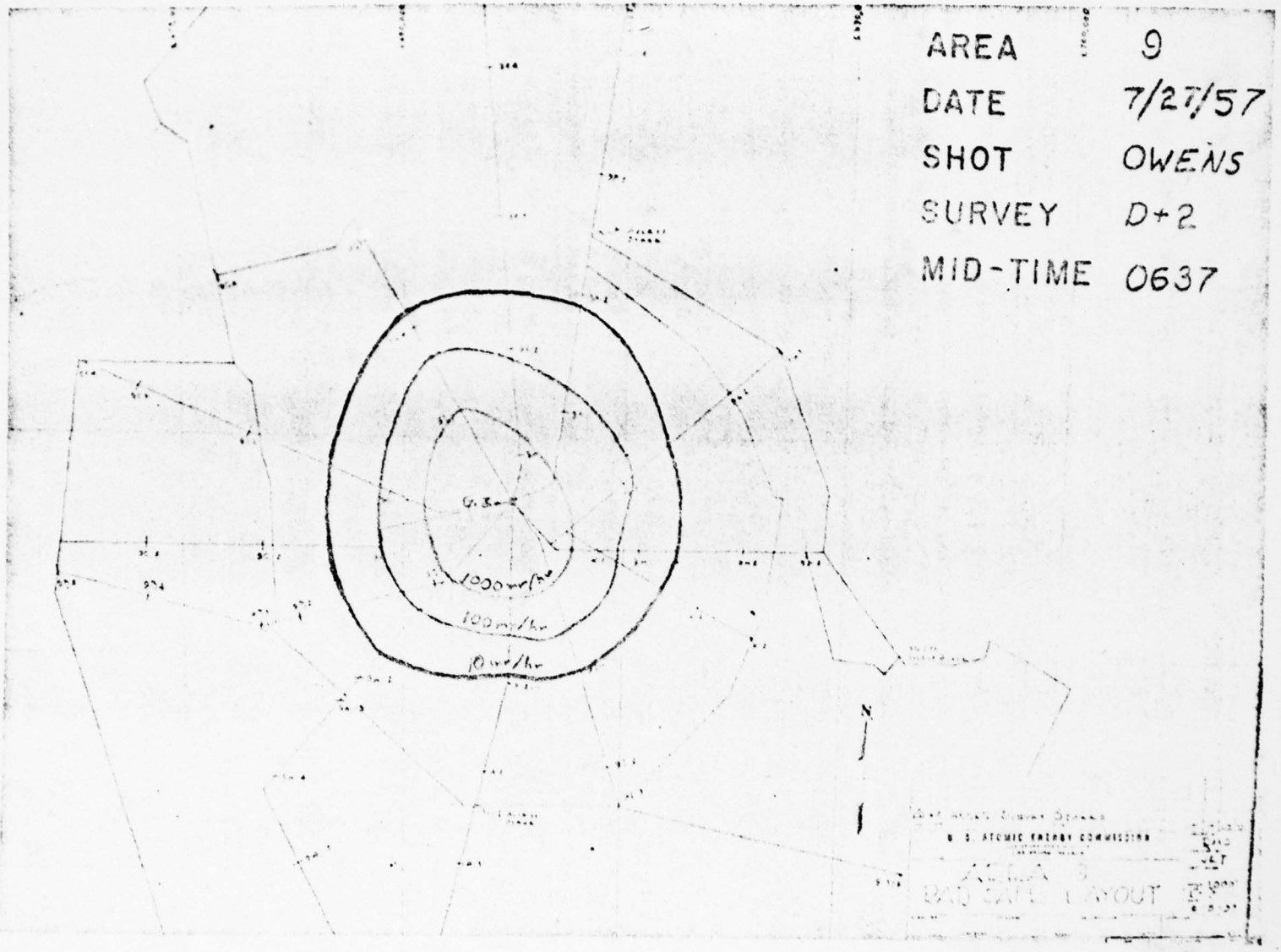

Figure 3.13.4 Owens, D + 2

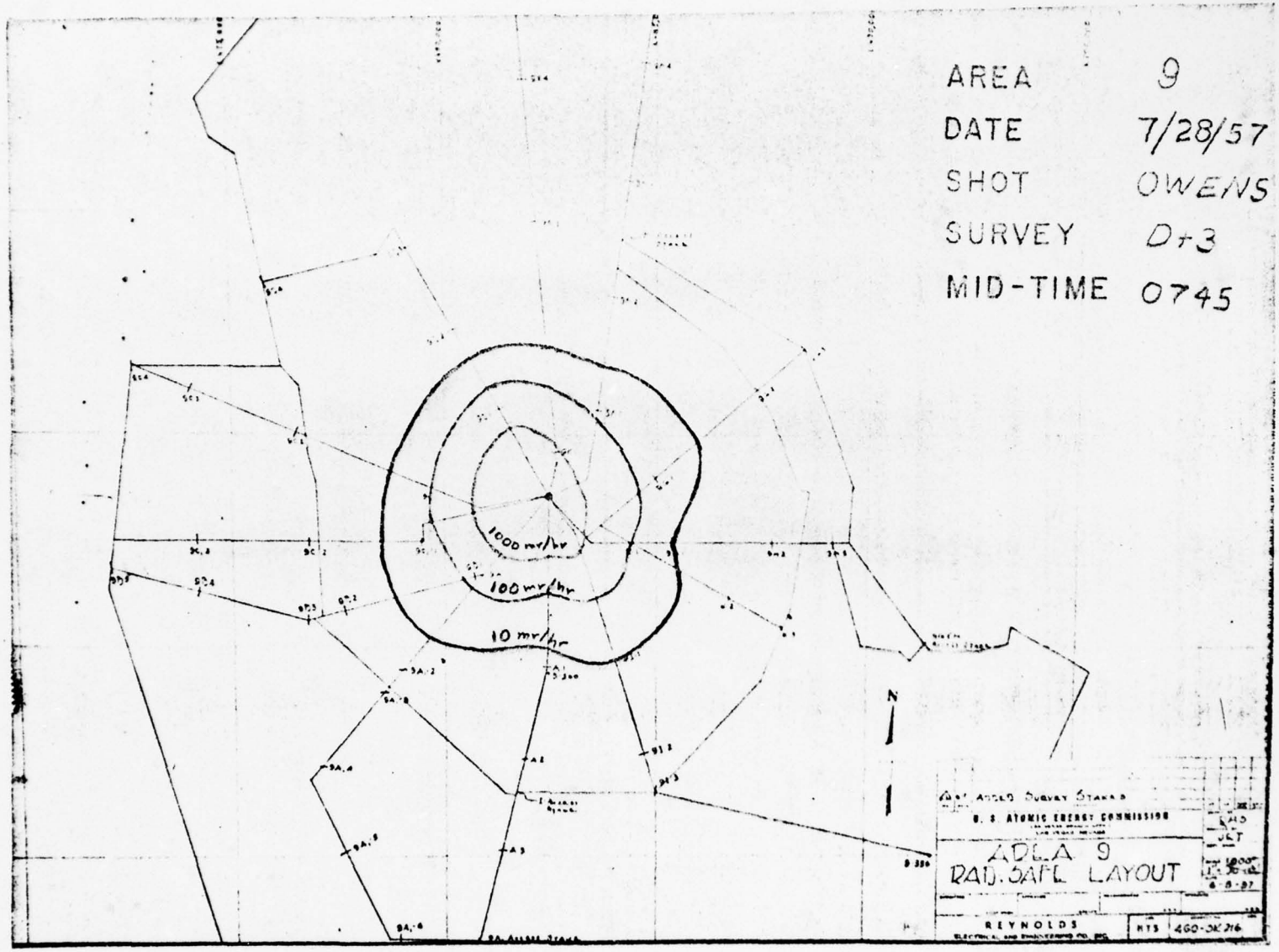

Figure 3.13.5 Owens, D + 3

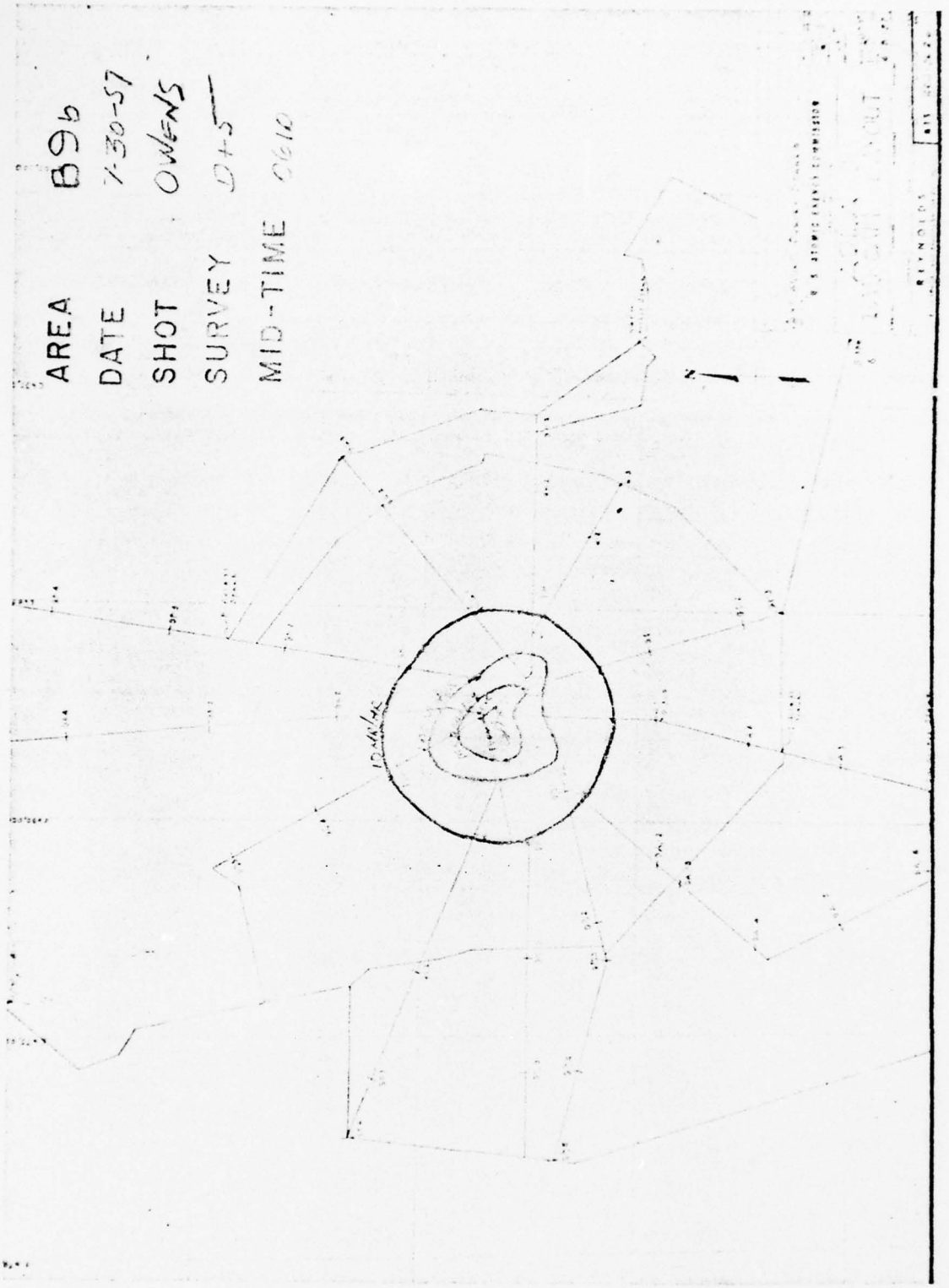

Figure 3.13.6 Owens, D + 5

Location	Long-Lived Alpha d/m per M^3
CP-2	1.2
Area 2	8.5
Gate 385	
Area 13	1.2

Fallout Trays

Location	Long-Lived Alpha d/m per ft^2
Warehouse 6	Background
Well 5	Background
CP-2	17
Area 2	330
Gate 385	353
Area 13	420
Shot Area (Average)	1040 (1 set)

No increase in radioactivity was noted in well and drinking water.

The following samples were analyzed in the laboratory:

Type	Number
Air Samples	213
Nasal Swabs	83
Surface Swipes	439
Fallout Trays	161
Water Samples	13
Total	909

3.13.5 Training Branch

Twelve Canadian Navy personnel were given a one-hour orientation lecture and tour of the CP-2 on July 27.

Twenty-three FCDA personnel were given a four-hour Rad-Safe training lecture. They also were taken on a tour of the CP-2.

Five visiting Medical Corps personnel were given a two-hour lecture and tour of the CP-2 on July 31.

3.13.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
July 24	76	509
July 25	1207	862
July 26	884	998
July 27	816	1439
July 28	359	438
July 29	419	443
July 30	225	645
Aug. 1	270	636
Aug. 2	190	489
Aug. 3	191	484
Aug. 4	198	274
Aug. 5	257	397
Totals	5230	7952

Dosimeters:

Date	Issued	Received
July 24	167	60
July 25	253	290
July 26	240	200
July 27	44	54
July 28	46	58
July 29	91	120
July 30	66	90
July 31	42	60
Aug. 1	46	65
Aug. 2	66	60
Aug. 3	74	10
Aug. 4	20	15
Aug. 5	41	46
Totals	1196	1128

3.13.7 Logistics Branch

Ant-contamination clothing, materials and supplies were issued to 3020 people as follows:

Item	Number
Coveralls	1741
Shoe Covers (pairs)	2755
Respirators	516
Other Items	4717

The laundry processed 14,691 pieces of anti-contamination items.

3.14 Pascal "A" (July 26, 1957)

Pascal "A" was a device fired in a deep well in Area U3J. The device was detonated at 0100 hours on July 26, 1957. It was the third safety experiment of the Plumbbob series.

3.14.1 General Monitoring Branch

When the test became a nuclear detonation, the Test Director's Rad-Safe Officer ordered the forward area evacuated at 0110 hours. At 0111 hours, one monitor was dispatched to Area 12 to assist in the evacuation of personnel working there. This evacuation delayed the initial survey until 0515 hours. The survey for beta and gamma radiation was completed at a mid-time of 0620 hours. Two Rad-Safe monitors were utilized. No alpha survey was made because rain and high humidity prevented a reasonable evaluation, but barricades were placed to prevent entry into Area 3. Two Rad-Safe monitors completed an alpha survey of the area at 0930 hours

The ground surveys of non-shot areas were performed by two Rad-Safe monitors. One surveyed the Mercury Highway from the CP-2 to the BJY. The other monitor remained with FSI personnel at Security Gate 4.

Significant readings outside the shot area were as follows:

Itensity mr/hr	Location	Time hours
20	Gate 4	0200

Four monitors surveyed Building 311, the CP Area, personnel and vehicles. Approximately 75 people and 25 vehicles were processed through the decontamination facilities between 0130 and 0330.

At 0500 hours, the escort monitor returned from Area 12. No personnel remained forward of the Security Gate 4 after this time.

At 0710 hours, Areas 3 and 7 remained closed because of contamination.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
July 26	D / 1/3	0920
July 26	D / 1/3 (supplement)	1029
July 27	D / 1	0747
July 28	D / 2	0606
July 29	D / 3	0637
July 31	D / 5	0614
Aug. 2	D / 7	0614

A vehicle check station was established on the main access road into Area 3 and maintained daily from July 26 to August 4 during 0600 to 1900 hours.

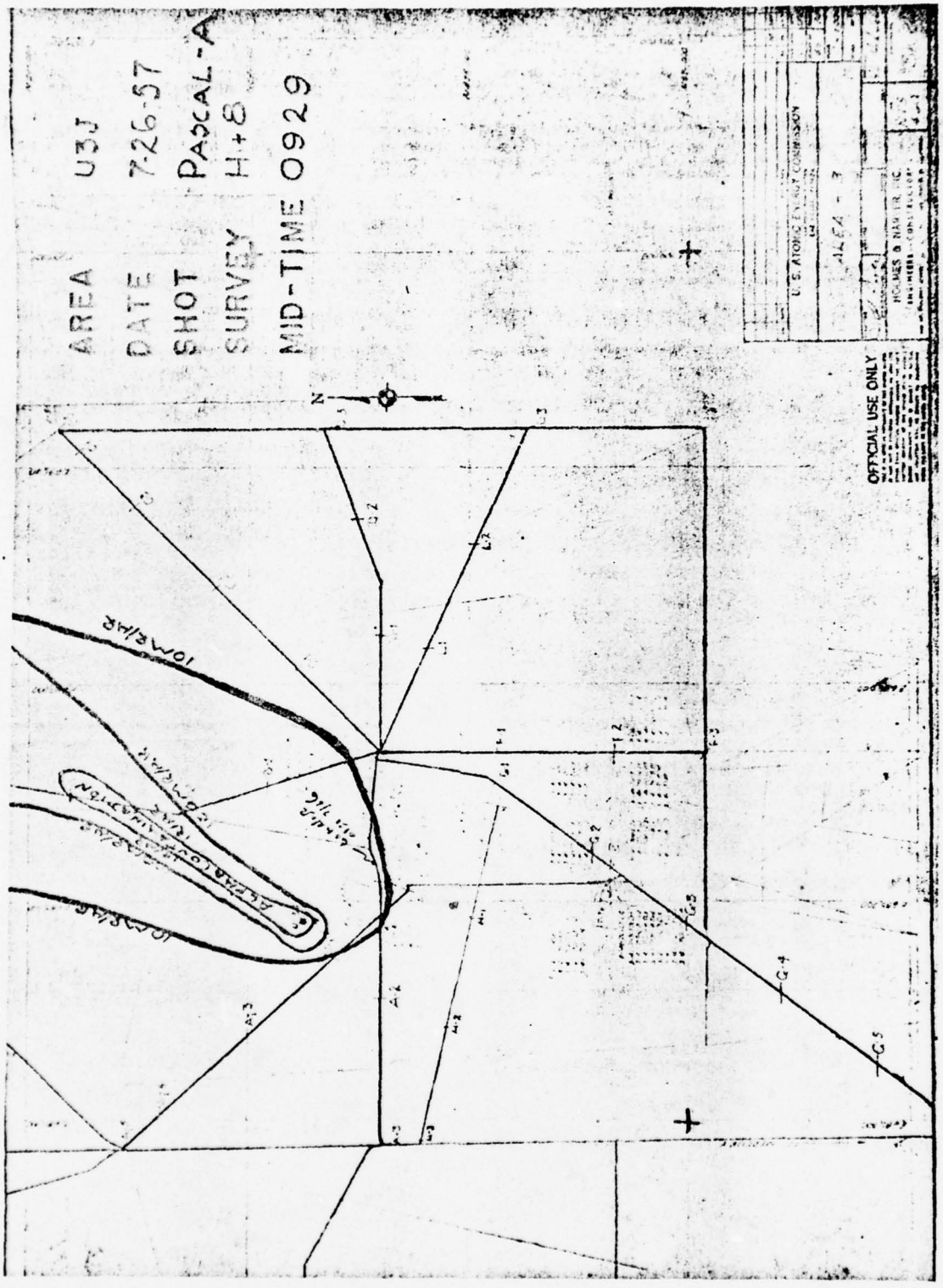

Figure 3.14.1 Pascal "A", H + 8

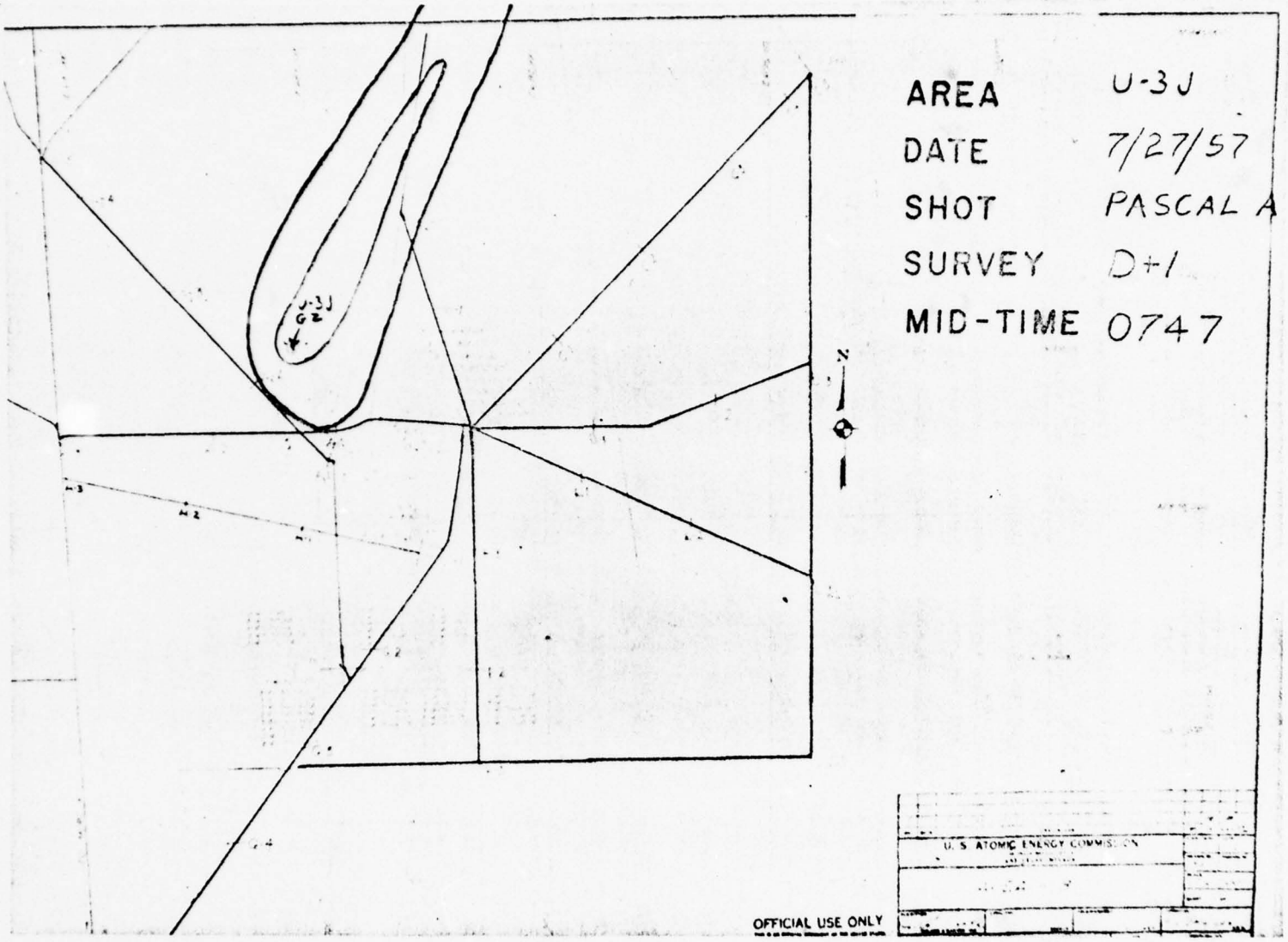

Figure 3.14.2 Pascal "A", D + 1

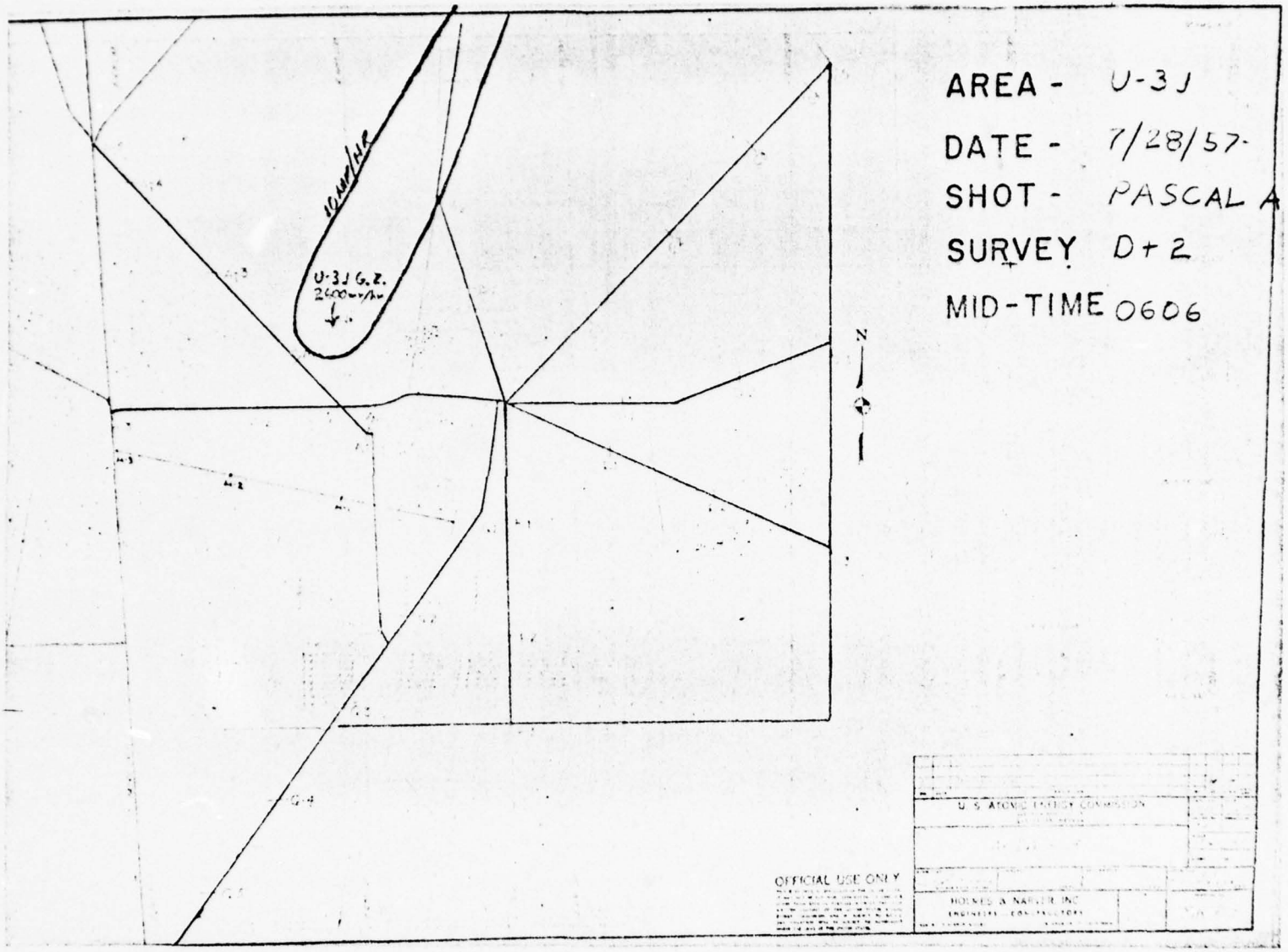

Figure 3.14.3 Pascal "A", D + 2

3.14.2 Plotting and Briefing Branch

Results of the surveys were plotted for display at various locations. (Figures No. 3.14.1 through 3.14.3).

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
July 26 to 27 (inclusive)	5	3	23
Total	5	3	23

3.14.3 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
July 26	884	884
Total	884	884

Dosimeters:

Date	Issued	Received
July 26	240	240
Total	240	240

3.14.4 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 23 persons as follows:

Item	Number
Coveralls	23
Shoe Covers (pairs)	23
Respirators	23
Other Items	92

3.15 Stokes (August 6 through August 16, 1957)

Stokes was fired from a balloon anchored 1500 feet above Area 7b. The device was detonated at 0525 hours on August 6, 1957. The mushroom cloud extended from about 22,000 feet to above 35,000 feet MSL. Wind shear spread the air mass across a wide front. The leading edge of the mass was blown generally north-northeast at 55 to 60 knots. A heavy stem of dust rose to about 20,000 feet but did not join the

mushroom top. It also was dissipated over a wide front but moved more slowly to west of north.

3.15.1 General Monitoring Branch

The initial aerial survey team departed from the CP helicopter pad at 0700 hours. The results obtained from this survey were as follows:

Intensity r/hr	Location	Altitude feet	Time hour	Area
3	Ground Zero	400	0713	7b
10	Ground Zero	200	0720	7b

Subsequent aerial re-surveys at an altitude of 15 feet provided the following measurements:

Intensity r/hr	Location	Time hour	Area	Re-survey days
6	Ground Zero	0935	7b	D / 2

The initial ground survey teams departed at 0530 hours.

The ground team for the surveys of non-shot areas departed at 0540 hours. Results of this survey were as follows:

Intensity mr/hr	Location	Time hours	Area
Background	Well 3	0534	Yucca Flat
Background	BJY	0538	Yucca Flat
Background	Area 3b GZ	0536	3
Background	Area 3a GZ	0545	3
5	Area 2c GZ	0554	9
5	Area 1 GZ	0559	1
As Posted	Area 4 GZ	0612	4
As Posted	Area 9	0607	9
Background	Tunnel Site	0616	12
Background	Area 2 GZ	0618	2
Background	Area 2a GZ	0618	2
8	Gate 385	0557	Yucca Flat

A check station was established one-tenth mile north of the BJY, on the east leg and remained operational until August 14.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
Aug. 7	D / 1/4	1133
Aug. 8	D / 1	0541
Aug. 9	D / 2	0548

Date	Re-survey days	Mid-time hours
Aug. 10	D / 3	0620
Aug. 11	D / 4	0601
Aug. 12	D / 5	0552

There were six monitors provided for projects and REECO support.

3.15.2 Plotting and Briefing Branch

Results of the surveys were plotted for display at various locations. (Figures No. 3.15.1 through 3.15.7).

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
Aug. 7	94	15	325
Aug. 8	82	17	167
Aug. 9	83	15	220
Aug. 10	59	13	90
Aug. 11	27	10	57
Aug. 12	108	17	309
Aug. 13	88	17	283
Aug. 14	86	13	258
Aug. 15	85	15	290
Aug. 16	63	12	187
Aug. 17	45	9	99
Totals	820	153	2295

3.15.3 Decontamination Branch

The following items were decontaminated at the CP-6:

Equipment	Number
Vehicles	132
Road Graders	2

The following items were decontaminated at the BJY Field Decontamination Station:

Equipment	Number
Transformers	2

3.15.4 Special Assignments Branch

The following radioactive material was monitored and cleared for release from the Nevada Test Site:

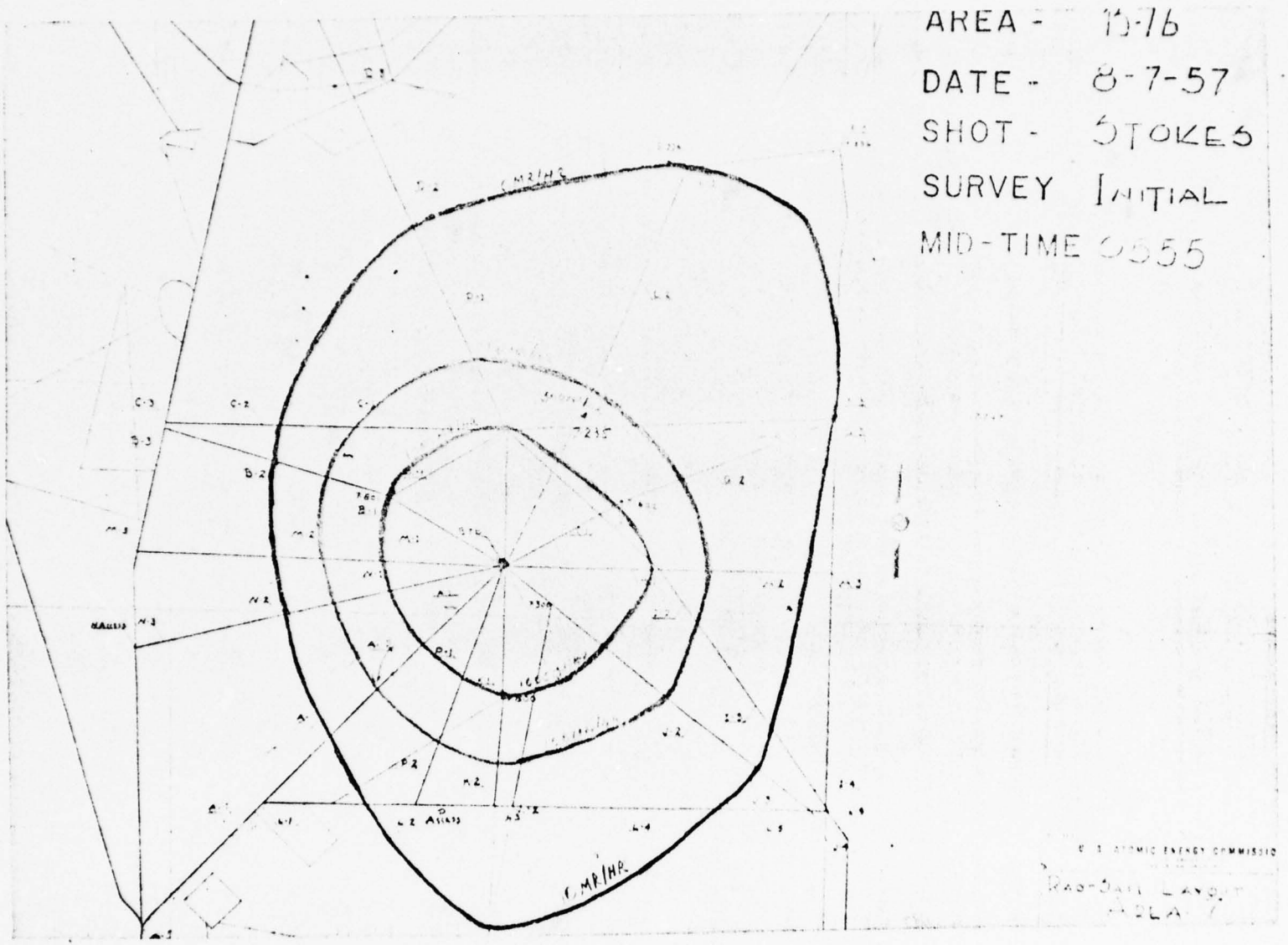

Figure 3.15.1 Stokes, Initial

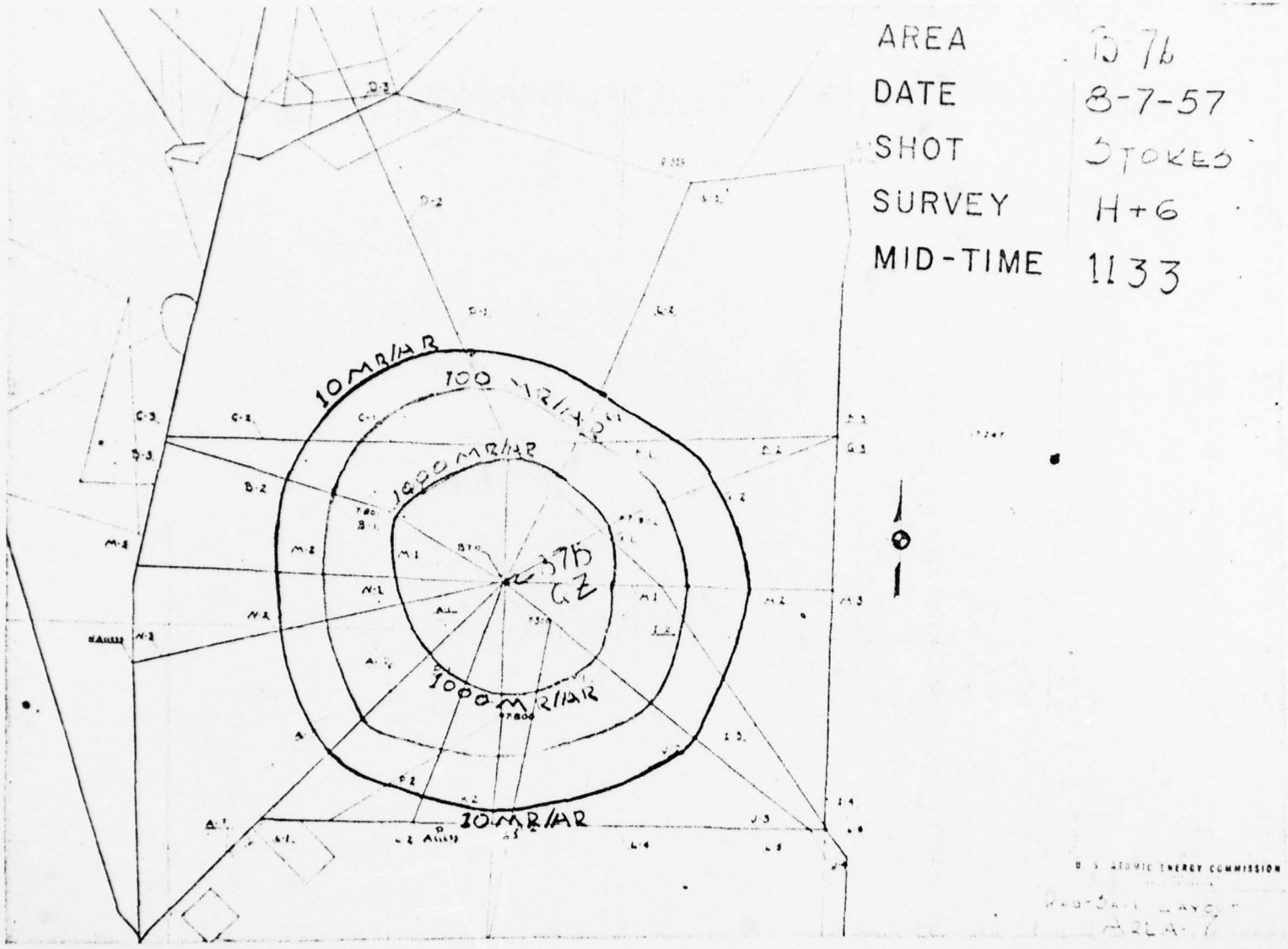

Figure 3.15.2 Stokes, H + 6

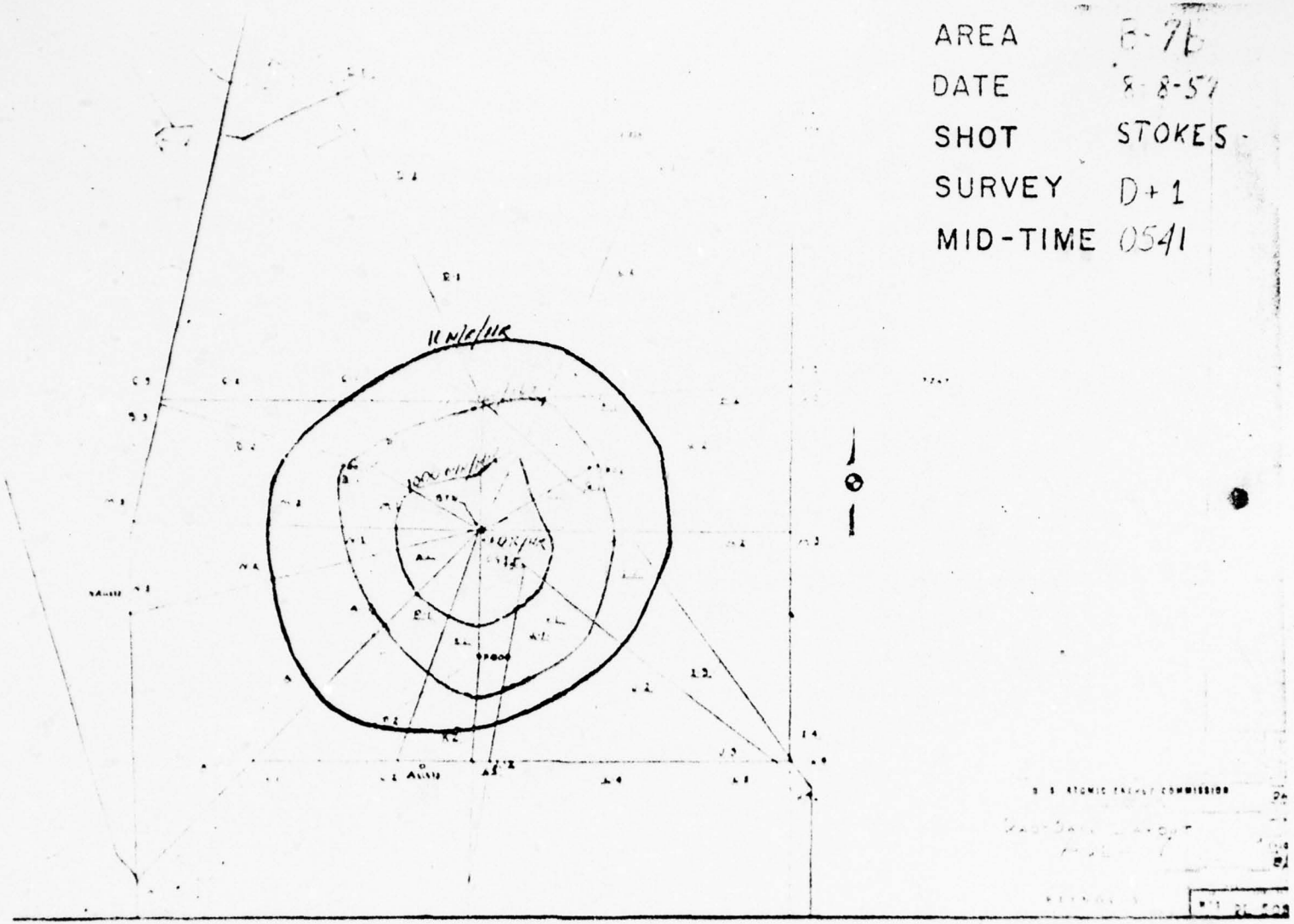

Figure 3.15.3 Stokes, D + 1

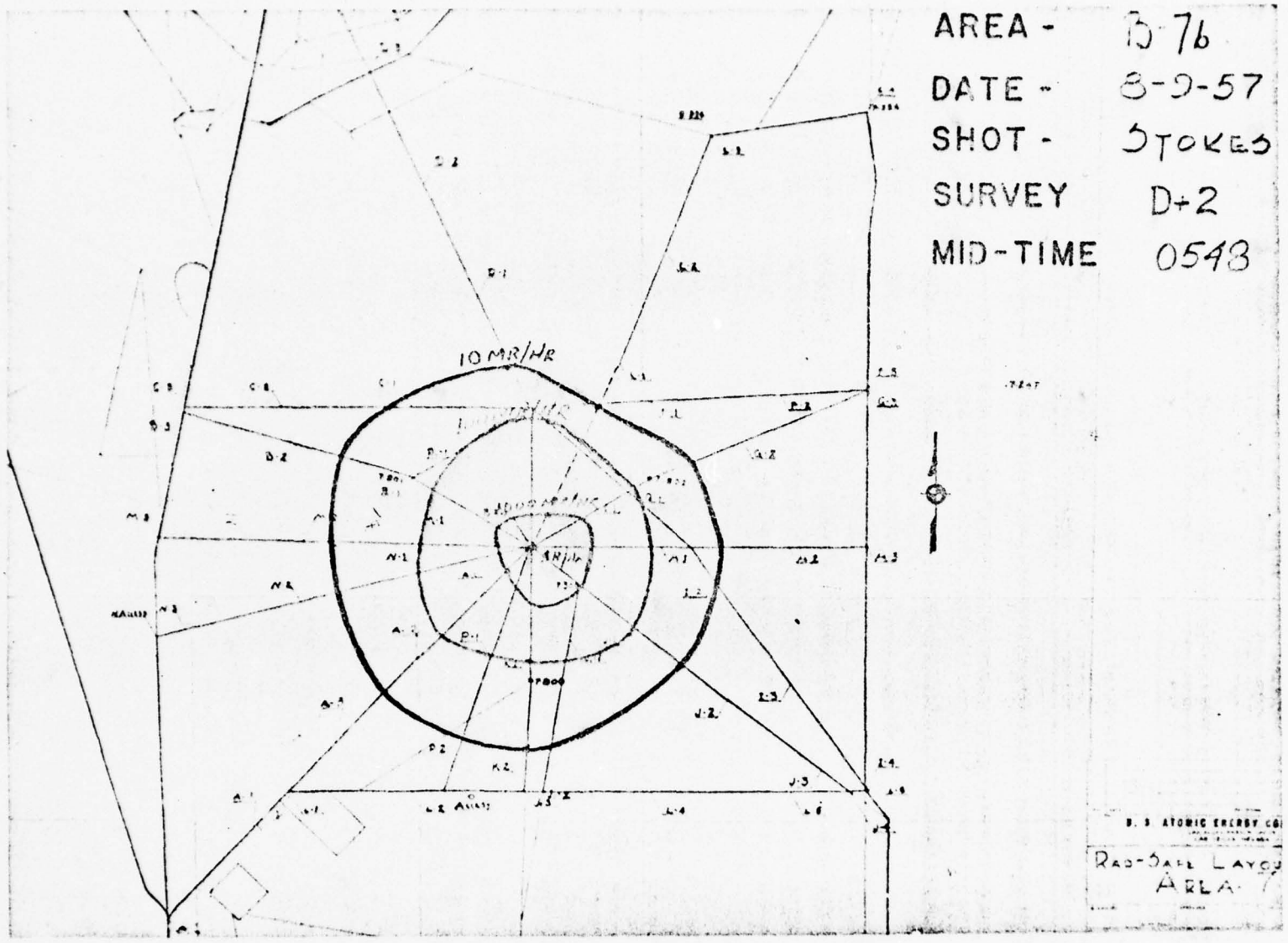

Figure 3.15.4 Stokes, D + 2

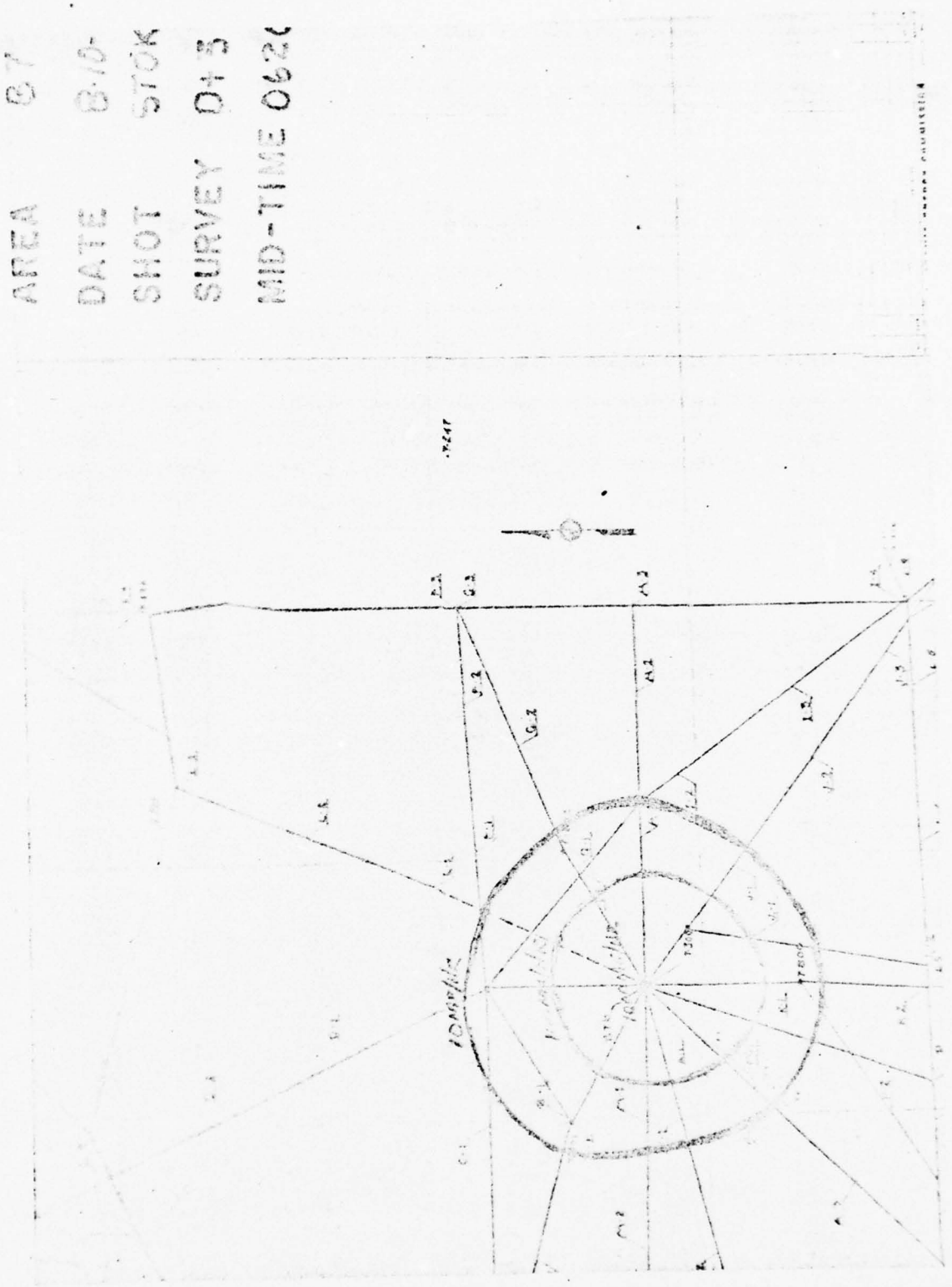

Figure 3.15.5 Stokes, D + 3

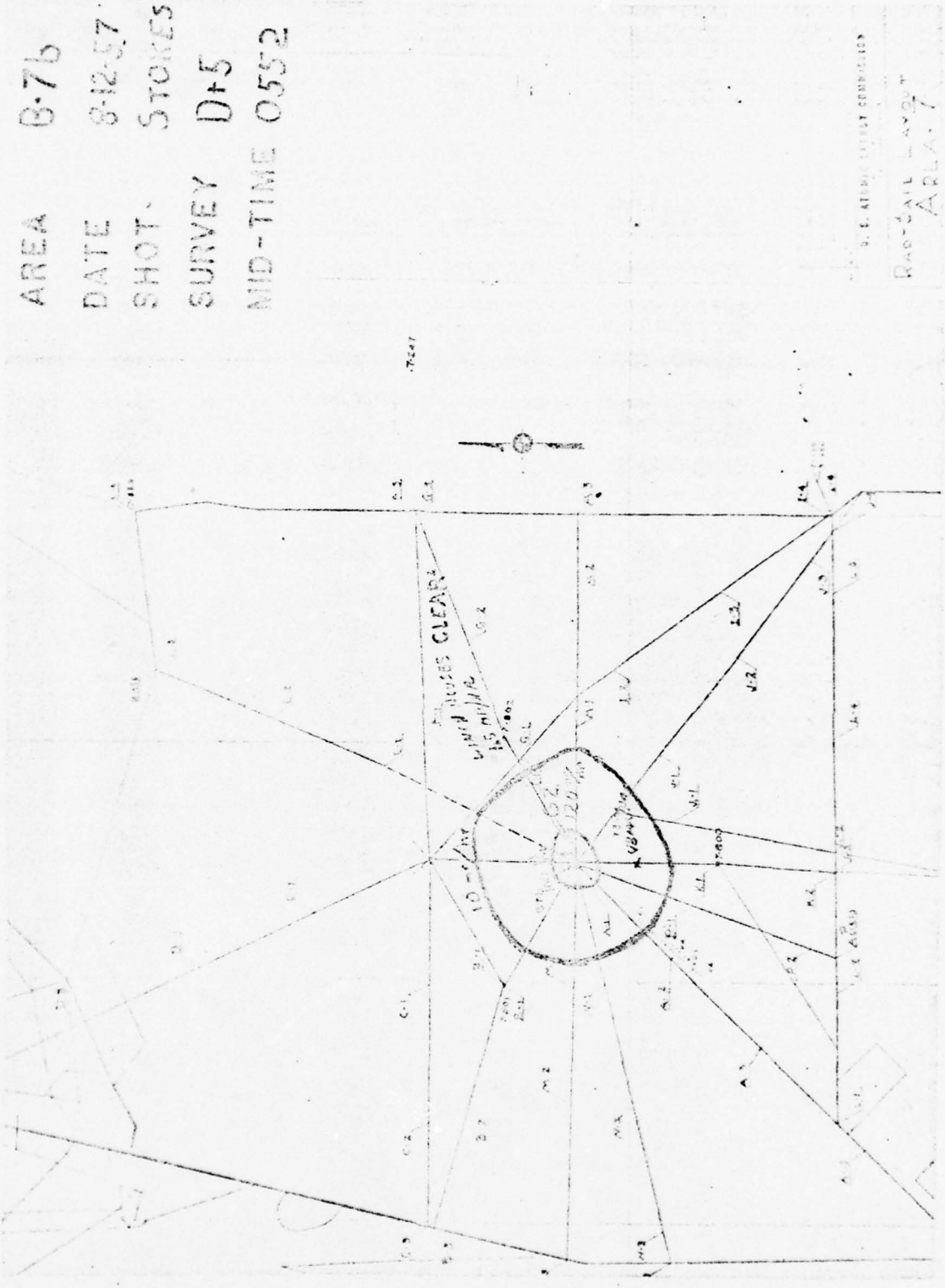

Figure 3.15.6 Stokes, D + 5

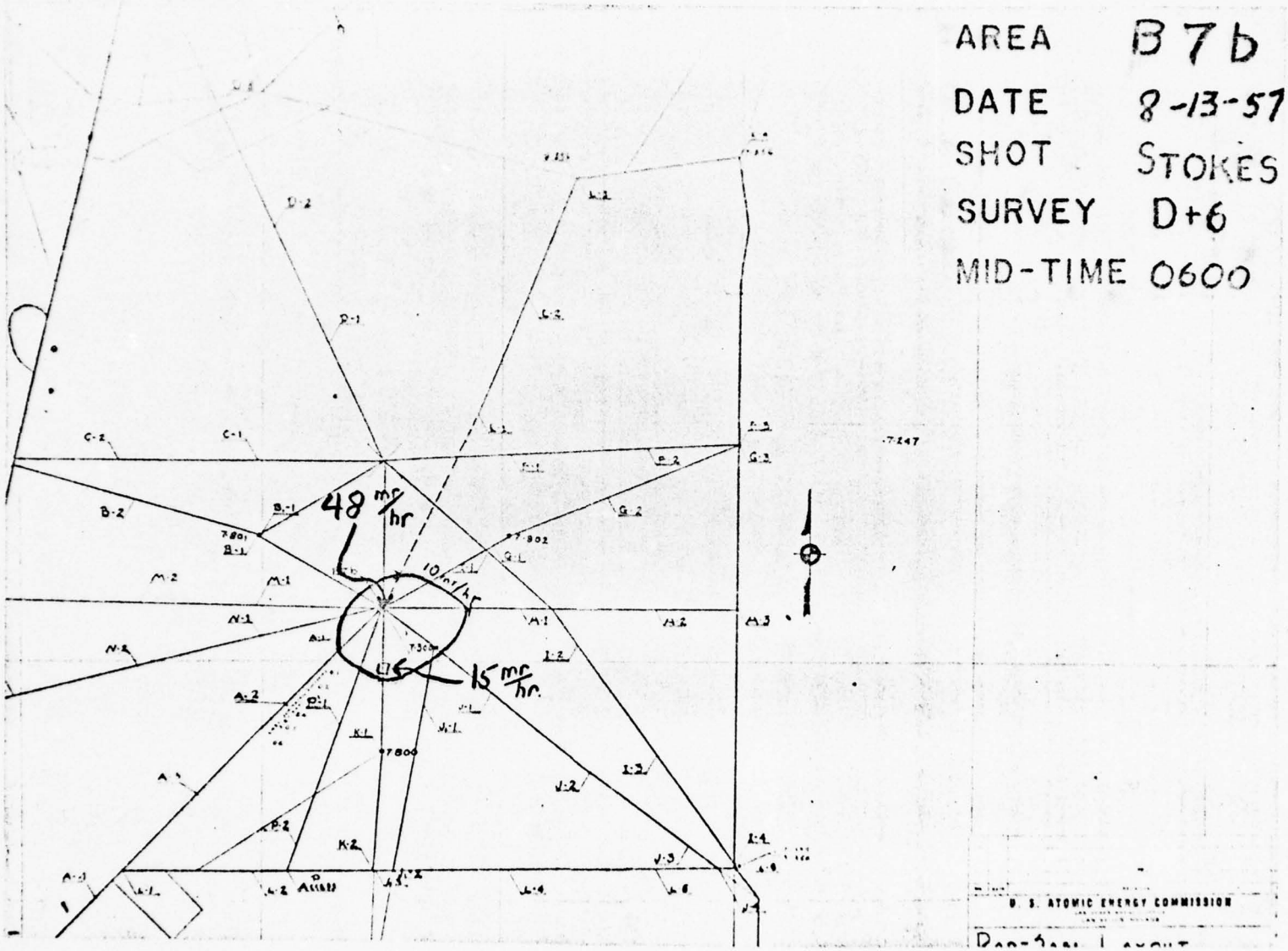

Figure 3.15.7 Stokes, D + 6

Material	No. of Boxes	Agency
Soil Samples	1	Project 32.1
Raripactor Filters	1	Sandia Corp.
Co^{60} Source	1	Project 2.5

Air-borne Radioactivity (D-day Averages):

Air Samples:

Location	Long-Lived Alpha d/m per M^3
Warehouse 6	Background
CP-2	Background
Gate 385	Background
Area 13	0.1

Fallout Trays:

Location	Long-Lived Alpha d/m per ft^2
Warehouse 6	Background
Well 5	Background
CP-2	118
Area 2	101
Gate 385	101
Area 13	17
Shot Area (Average)	31

No increase in radioactivity was noted in well and drinking water samples.

Radiation surveys of the "clean working and living areas" at Mercury and the CP Area showed an alpha contaminated spot (250 c/m/55cm^2) in the tool crib at Mercury and a beta-gamma contaminated spot (14 mr/hr) in the "hot" clothing removal room in the CP-2. Both spots were readily decontaminated.

The following samples were analyzed in the laboratory:

Type	Number
Air Samples	174
Nasal Swabs	56
Surface Swipes	888
Fallout Trays	105
Water Samples	13
Total	1236

3.15.5 Training Branch

A pre-shot orientation lecture was given to a group of approximately 100 official observers at the official observer area on August 7.

Fifty FCDA personnel were given a four-hour Rad-Safe lecture.

Six Medical Corps Officers were given a two-hour Rad-Safe lecture and tour of the CP-2 on August 14.

A three-day Basic Monitor Training Class was conducted for 11 persons.

3.15.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
Aug. 6	212	215
Aug. 7	225	328
Aug. 8	259	252
Aug. 9	139	189
Aug. 10	439	562
Aug. 11	125	104
Aug. 12	399	343
Aug. 13	276	217
Aug. 14	275	358
Aug. 15	247	239
Aug. 16	259	692
Totals	2855	3499

Dosimeters:

Date	Issued	Received
Aug. 6	18	18
Aug. 7	139	89
Aug. 8	40	30
Aug. 9	34	44
Aug. 10	30	25
Aug. 11	29	34
Aug. 12	24	20
Aug. 13	70	10
Aug. 14	16	16
Aug. 15	3	30
Aug. 16	2	22
Totals	405	338

3.15.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 2840 people as follows:

Item	Number
Coveralls	1041
Shoe Covers (pairs)	2591
Respirators	264
Other Items	1541

The laundry processed 8942 pieces of anti-contamination items.

3.16 Saturn (August 9, 1957)

Saturn was a device fired underground in Area U.12c. The device was detonated at 1800 hours on August 9, 1957. It was the fourth safety experiment of the Plumbbob series.

3.16.1 General Monitoring Branch

The General Monitoring Branch of the Rad-Safe Division performed an initial survey of the U-12c area and provided one party monitor. Three personnel were included in the initial survey.

The tunnel entrance and the surrounding area were monitored for both alpha and beta-gamma radiation. No significant radiation levels were detected between 1805 to 1900 hours. A re-survey was performed at U-12c and U-12b on August 10 at 0600 hours. Again no detectable radiation was found.

3.17 Shasta (August 17 through August 21, 1957)

Shasta was a device fired from a 500-foot tower in Area 2a. The device was detonated at 0500 hours on August 18, 1957. The main portion of the mushroom cloud rose above 30,000 feet MSL. Upper levels were being blown slowly to the east, with middle portions moving at low speeds to the northwest and lower portions to the north-northeast.

It was announced after the 1630 weather evaluation meeting on August 17 that Shasta had been postponed 24-hours. Later weather data indicated a change to an acceptable situation, and test personnel (many had left the Test Site after the earlier postponement) were immediately notified of the change. By shot time the Rad-Safe Division had sufficient personnel to function.

3.17.1 General Monitoring Branch

The aerial survey team departed from the CP helicopter pad at 0715 hours.

The results obtained from this survey were as follows:

Intensity mr/hr	Location	Altitude feet	Time hours	Area
25	Gate 385	25	0730	Yucca Flat
45	2-300	25	0731	2
2000	Area 2c GZ	200	0734	8

The initial ground survey teams departed at 0505 hours.

The results of the ground survey of non-shot areas were as follows:

Intensity mr/hr	Location	Time hours	Area
Background	Well 3	0512	Yucca Flat
Background	BJY	0513	Yucca Flat
Background	Greenhouse	0520	7
4	Area 1 GZ	0525	1
Same as Posted Aug. 8	Area 9 GZ	0536	9

Check stations to control access into the contaminated areas were established and maintained at the entrance to Areas 2a, 8 and 12.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
Aug. 18	D / 1/4	1124
Aug. 19	D / 1	0729
Aug. 20	D / 2	0650
Aug. 21	D / 3	0625

There were three monitors provided for projects and REECO support.

3.17.2 Plotting and Briefing Branch

Results of the surveys were plotted for display at various locations. (Figures No. 3.17.1 through 3.17.5).

A Shasta decay check stake was placed at a point in the field (N 866.700, E 665.100) approximately 1650 feet from ground zero on a bearing of 72 degrees east of north at 1140 hours on August 20, 1957. Daily intensities were recorded and plotted to obtain a decay curve. Interpretation of the data indicated the bulk of the contamination appeared to be Sodium 24 (half-life of 15 hours).

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
Aug. 18	47	17	161
Aug. 19	103	16	264
Aug. 20	92	16	308
Aug. 21	87	14	227
Aug. 22	88	15	272
Totals	417	78	1232

3.17.3 Decontamination Branch

The following items were decontaminated at the CP-6:

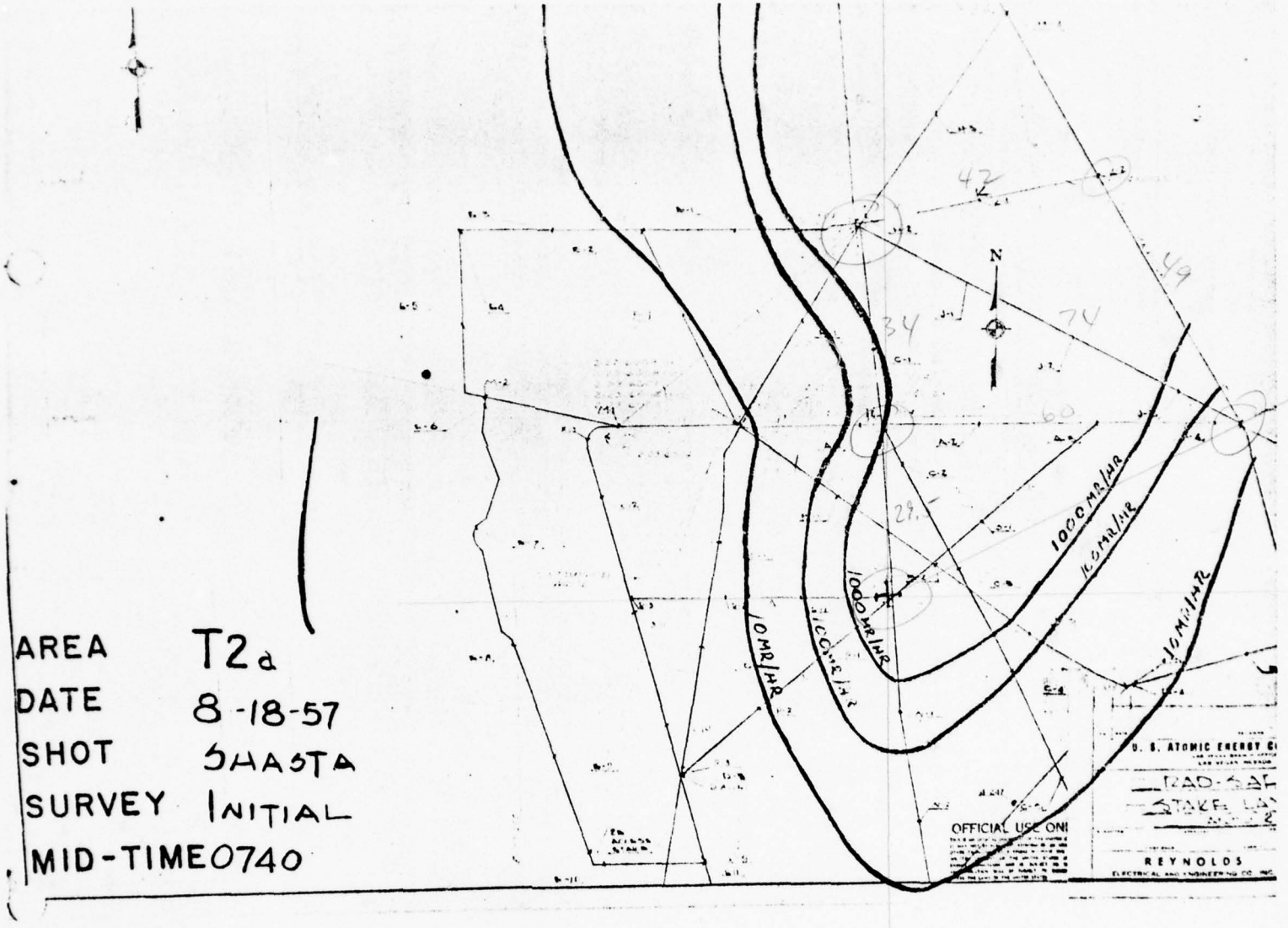

Figure 3.17.1 Shasta, Initial

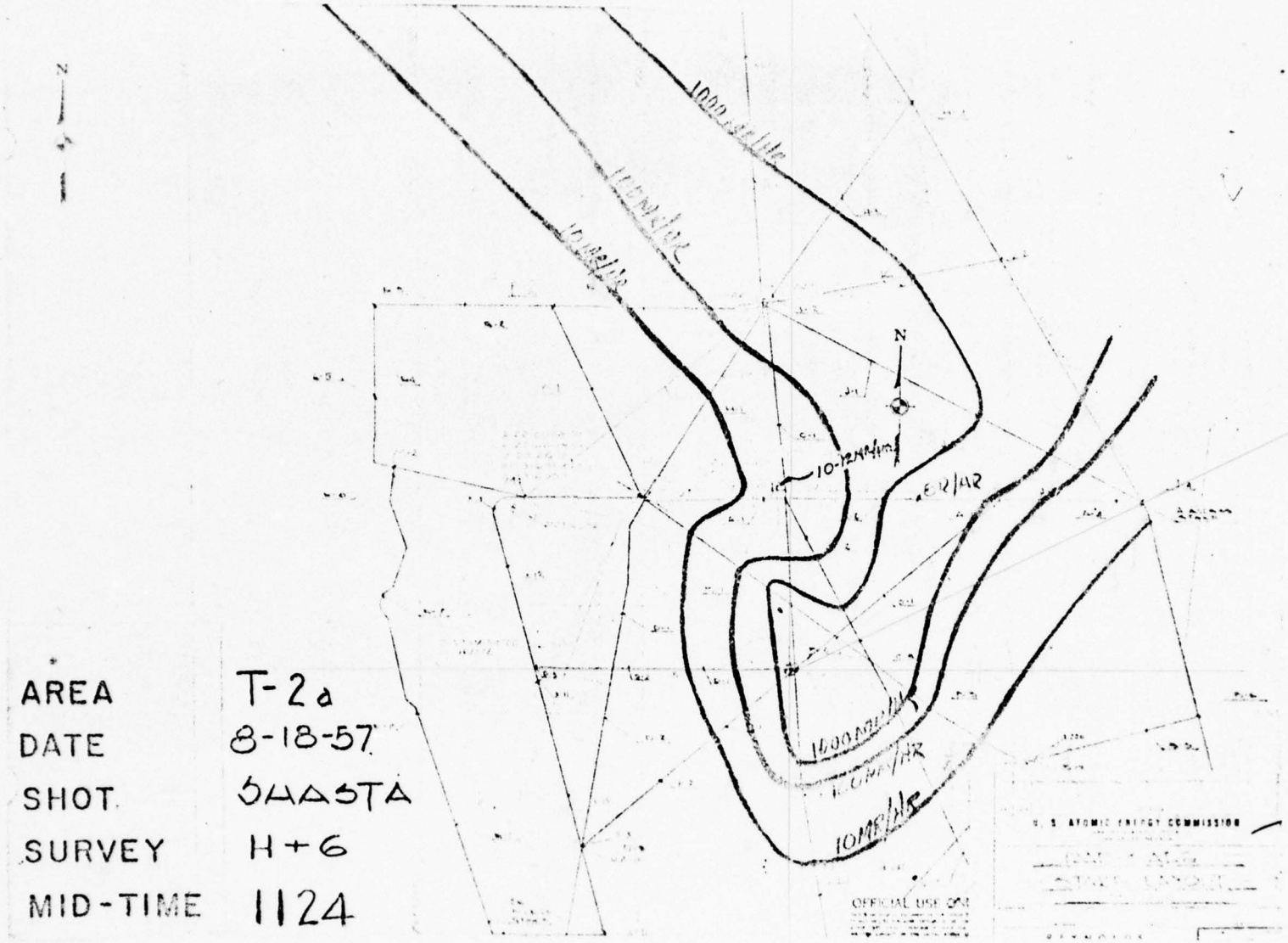

Figure 3.17.2 Shasta, H + 6

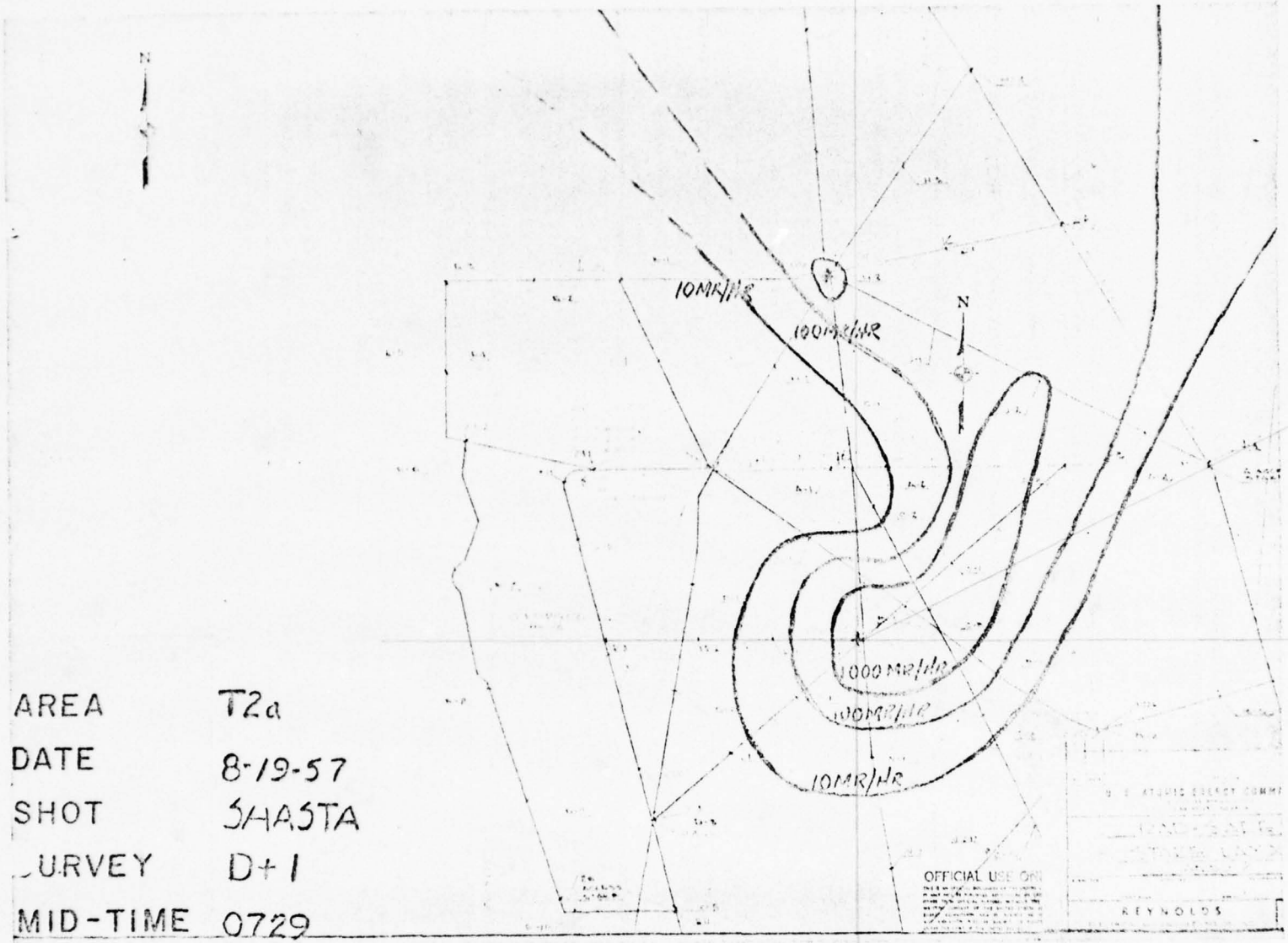

Figure 3.17.3 Shasta, D + 1

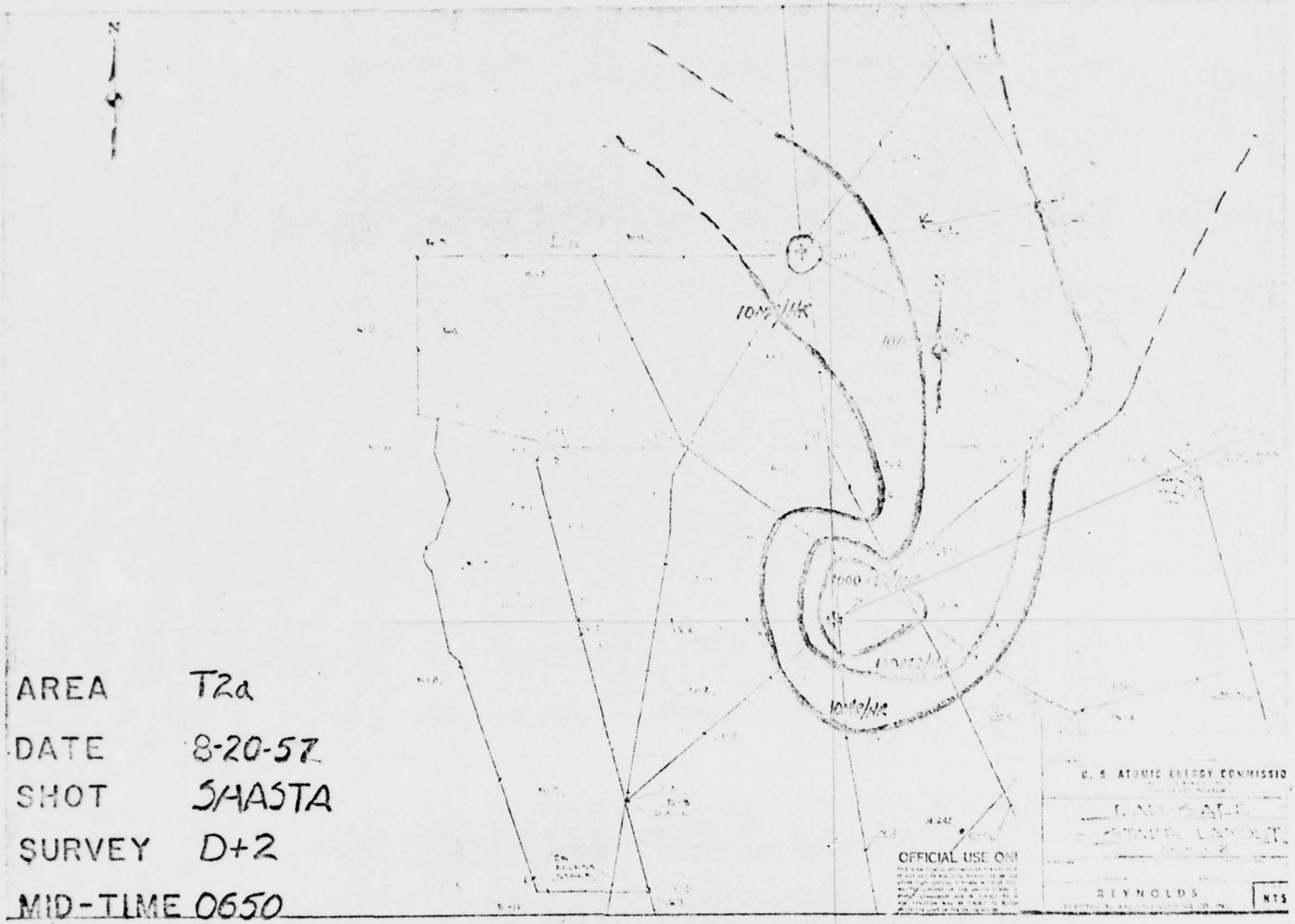

Figure 3.17.4 Shasta, D + 2

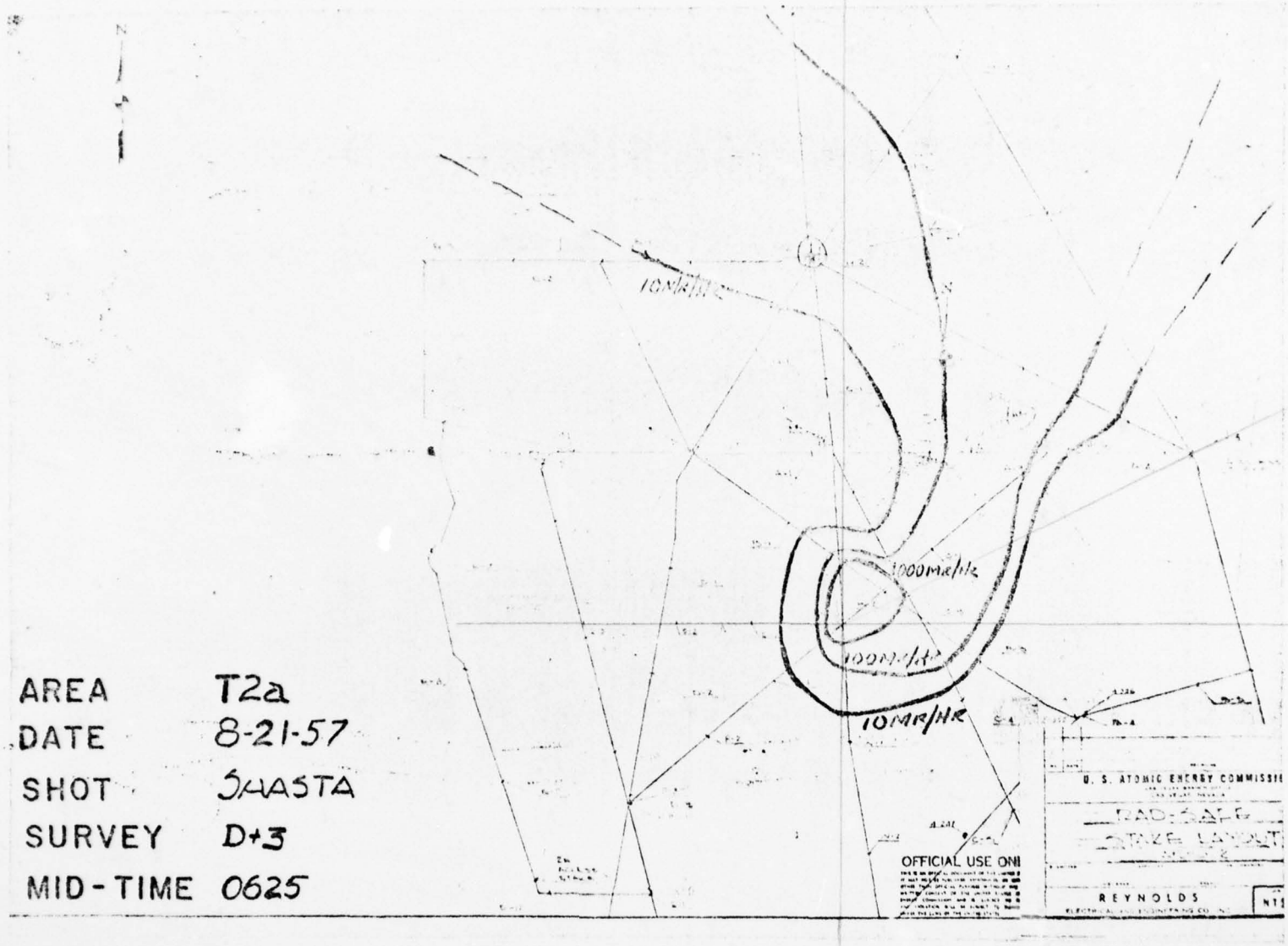

Figure 3.17.5 Shasta, D + 3

Equipment	Number
Vehicles	72
Bulldozer	1

3.17.4 Special Assignments Branch

The following radioactive material was monitored and cleared for release from the Nevada Test Site:

Material	No. of Boxes	Agency
Fallout Samples	1	Project 32.3, NRDL*

* Naval Radiological Defense Laboratory

Immediately following the detonation, a maximum level of 8 mr/hr beta-gamma was encountered on the highway between the CP Area and Mercury in the vicinity of the Cane Springs road.

Air-borne Radioactivity (D-day Averages):

Air Samples:

Location	Long-Lived Alpha d/m per ft^3
Warehouse 6	Background
CP-2	0.1
Gate 385	0.1
Area 13	0.6

Fallout Trays:

Location	Long-Lived Alpha d/m per ft^2
CP-2	17
Gate 385	151
Area 13	50
Shot Area (Average)	158

Rainfall Samples:

Location	Long-Lived Alpha /uc/ml
Area 13	Background
Mercury	Background
Gate 385	Background
CP-2	Background

No increase in radioactivity was noted in well and drinking water.

Radiation surveys in "clean working and living areas" in Mercury and the CP Area were negative.

The following samples were analyzed in the laboratory:

Type	Number
Air Samples	83
Nasal Swabs	21
Surface Swipes	23
Fallout Trays	60
Water Samples	10
Total	197

3.17.5 Training Branch

The three-day Basic Monitoring Training Class was conducted for six persons.

3.17.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
Aug. 17	260	224
Aug. 18	123	264
Aug. 19	177	183
Aug. 20	363	385
Aug. 21	305	263
Totals	1304	1.319

Dosimeters:

Date	Issued	Received
Aug. 17	20	32
Aug. 18	102	102
Aug. 19	25	25
Aug. 20	33	40
Totals	202	231

3.17.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 1153 people as follows:

Item	Number
Coveralls	455
Shoe Covers (pairs)	1054
Respirators	137
Other Items	1148

The laundry processed 3288 pieces of anti-contamination items.

3.18 Doppler (August 22 through August 28, 1957)

Doppler was a device fired from a balloon suspended 1500 feet above Area 7b. The device was detonated at 0530 hours on August 23, 1957. The mushroom cloud rose to 36,000 feet MSL and began moving in a general north-northwesterly direction. The dust from the stem settled back to earth within the Test Site.

3.18.1 General Monitoring Branch

Aerial surveys at H / 15 minutes, H / 6 hours, D / 1, D / 2 and D / 3 days were cancelled at 0800 hours.

The initial ground survey teams departed at 0535 hours. Results of the ground survey of non-shot areas were as follows:

Intensity mr/hr	Location	Time hours	Area
Background	BJY	0543	Yucca Flat
12	Entrance to 2c Access Road	0551	8
3	Area 2c GZ	0557	8
2	Gate 385	0607	Yucca Flat
Background	Tunnel Sites	0646	12

A check station to control access into the contaminated area was established 0.1 mile east of the BJY on the Area 7 access road. A check station to control access into a previously contaminated area was re-established 1.2 miles south of the intersection of the Area 2c access road and the Area 10 perimeter road.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
Aug. 23	D / 1/4	1142
Aug. 24	D / 1	0602
Aug. 25	D / 2	0606
Aug. 26	D / 3	0612
Aug. 28	D / 5	0615
Aug. 29	D / 6	0556

There were six monitors provided to projects and REECO support.

3.18.2 Plotting and Briefing Branch

The results of the surveys were plotted for display at various locations. (Figures No. 3.18.1 through 3.18.5).

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
Aug. 22	88	15	272
Aug. 23	109	18	356
Aug. 24	62	16	171
Aug. 25	15	15	31
Aug. 26	84	13	207
Aug. 27	78	16	215
Aug. 28	68	13	167
Totals	504	106	1419

3.3 Decontamination Branch

The following items were decontaminated at the CP-6:

Equipment	Number
Vehicles	69
Bulldozer	1

3.18.4 Special Assignments Branch

The following radioactive material was monitored and cleared for release from the Nevada Test Site:

Material	No. of Boxes	Agency
Fallout Samples	1	NRDL
Gum Film & Plywood Samples	1	Project 32.1
Whatman Samples	1	Project 32.1
Soil Samples	1	Project 32.3
Metal Box	1	Project 2.1
Raripactor Filters	1	Sandia Corp.
Aerial Survey Equipment	20	Project 2.1

No significant radiation levels were encountered on the highway between the CP-2 and Mercury after the detonation.

Air-borne Radioactivity (D-day Averages):

Air Samples:

Location	Long-Lived Alpha d/m per M^3
Warehouse 6	Background
CP-2	Background
Gate 385	Background
Area 13	Background

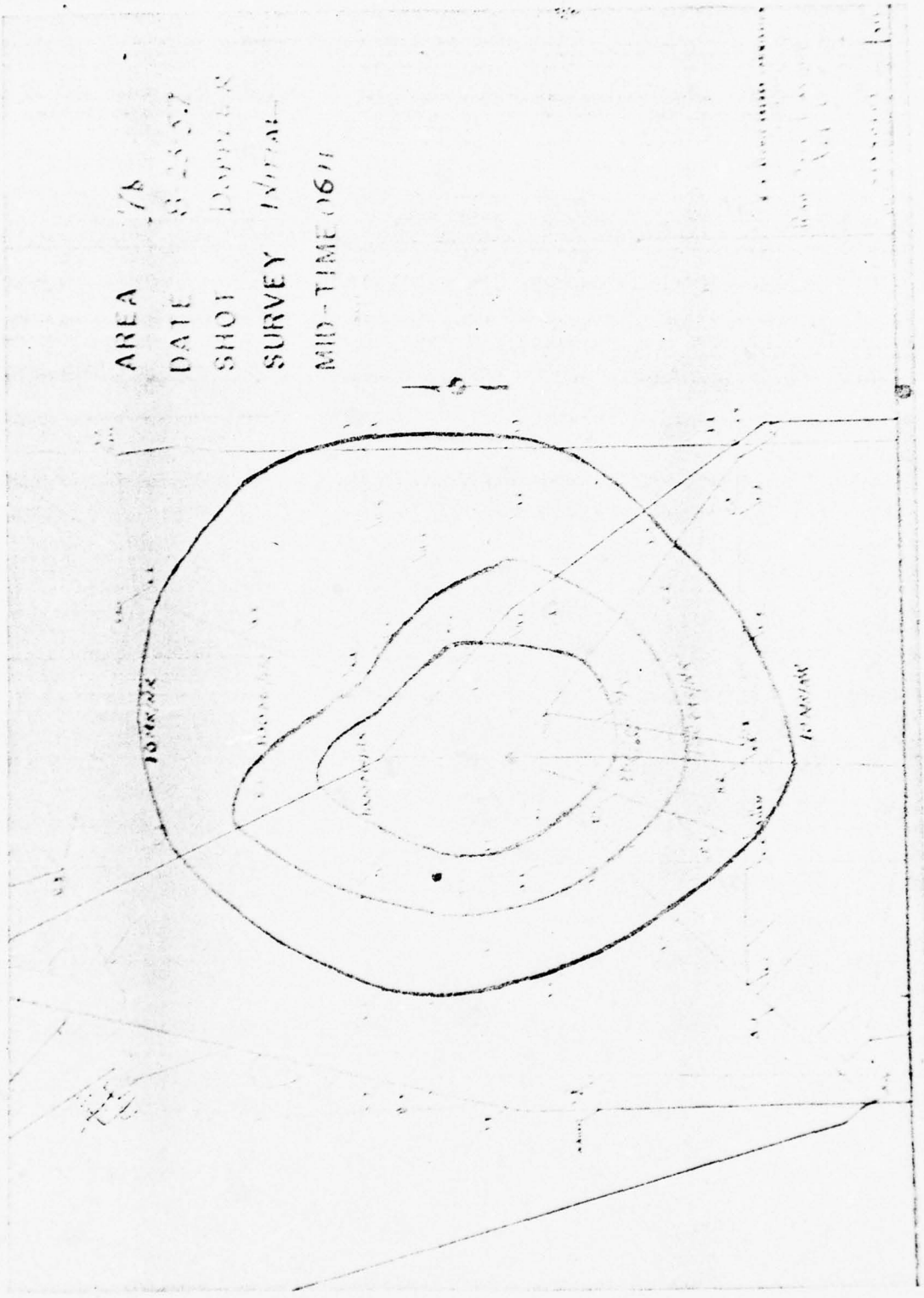

Figure 3.18.1 Doppler, Initial

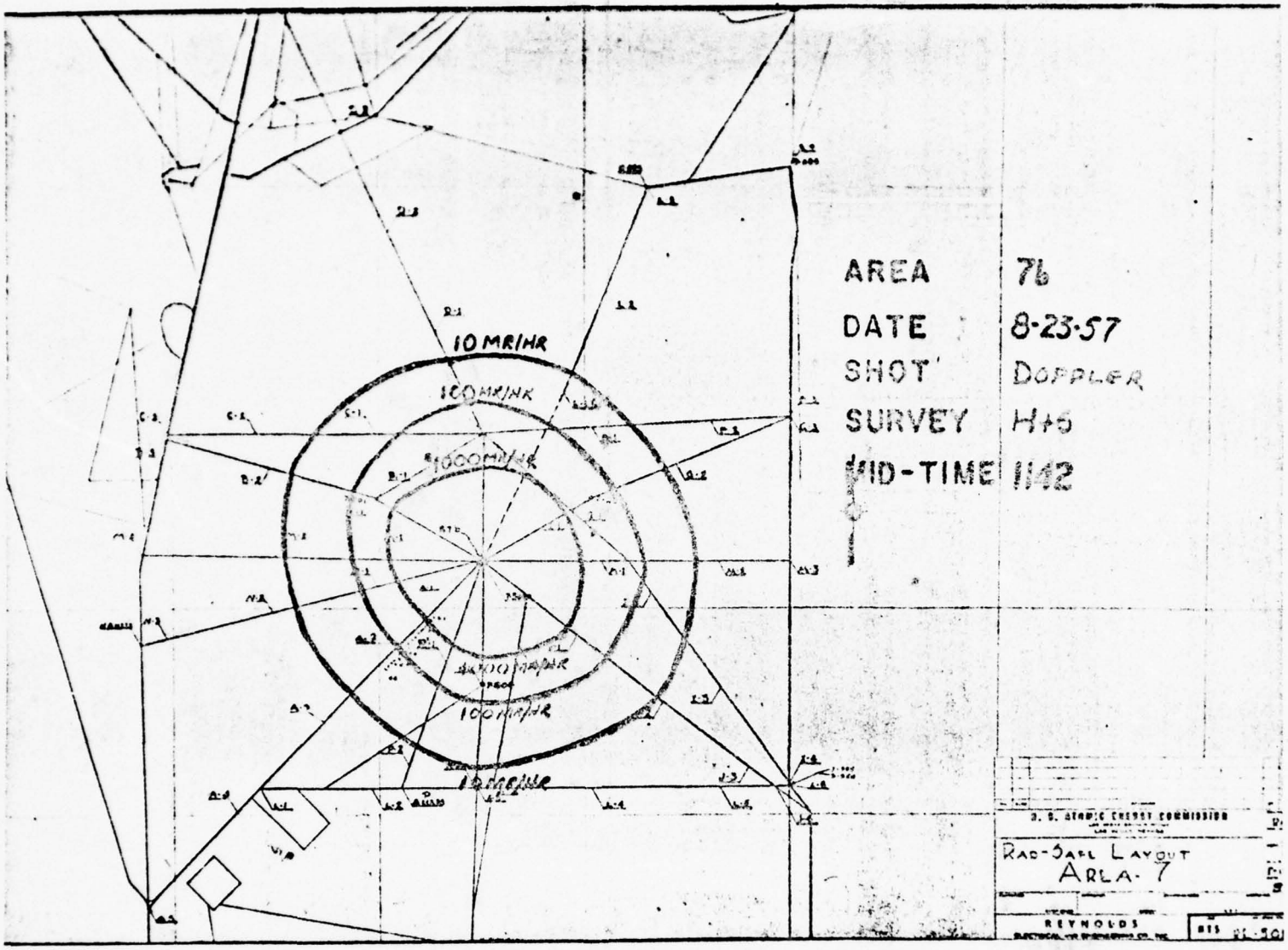

Figure 3.18.2 Doppler, H + 6

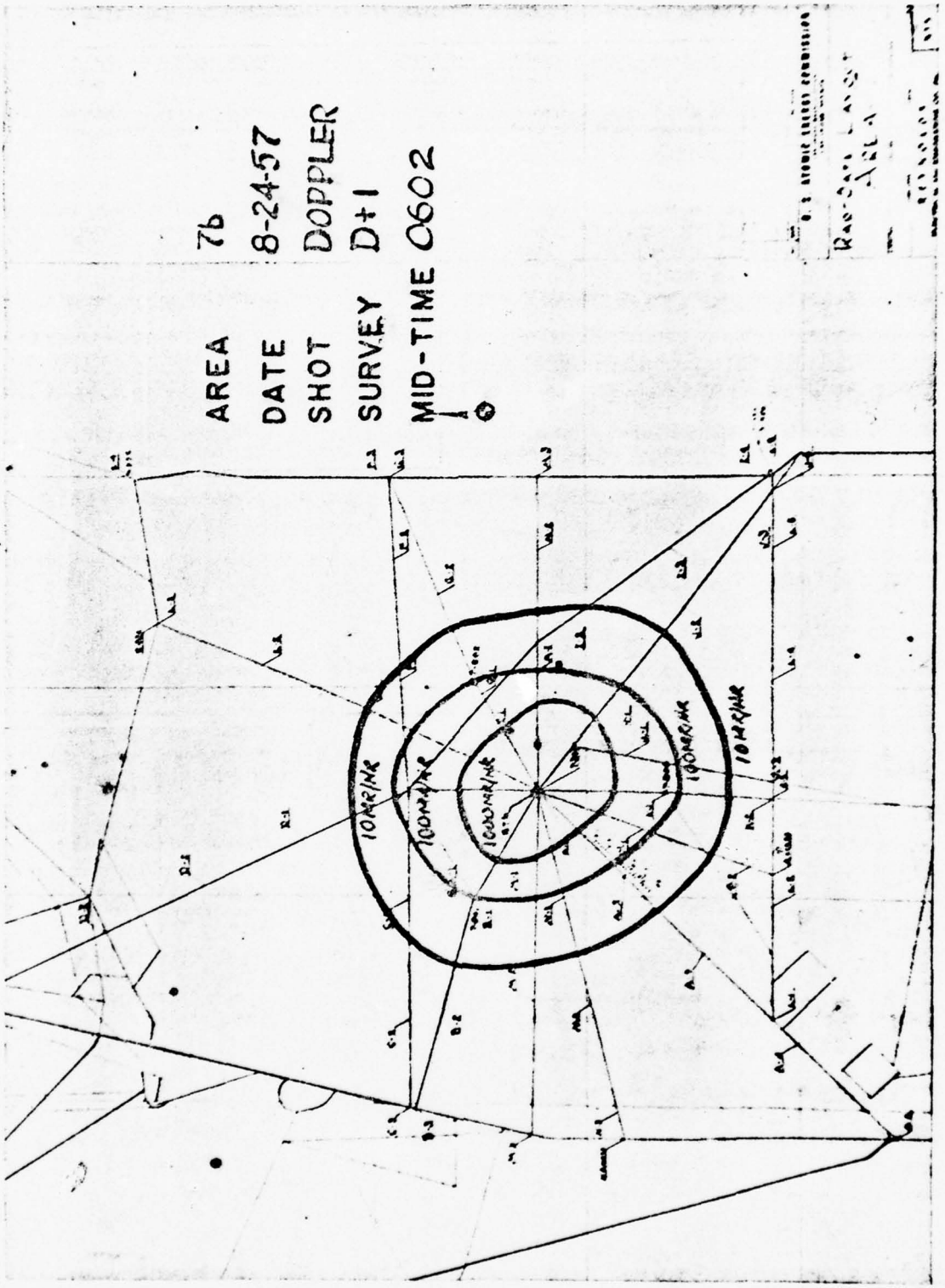

Figure 3.18.3 Doppler, D + 1

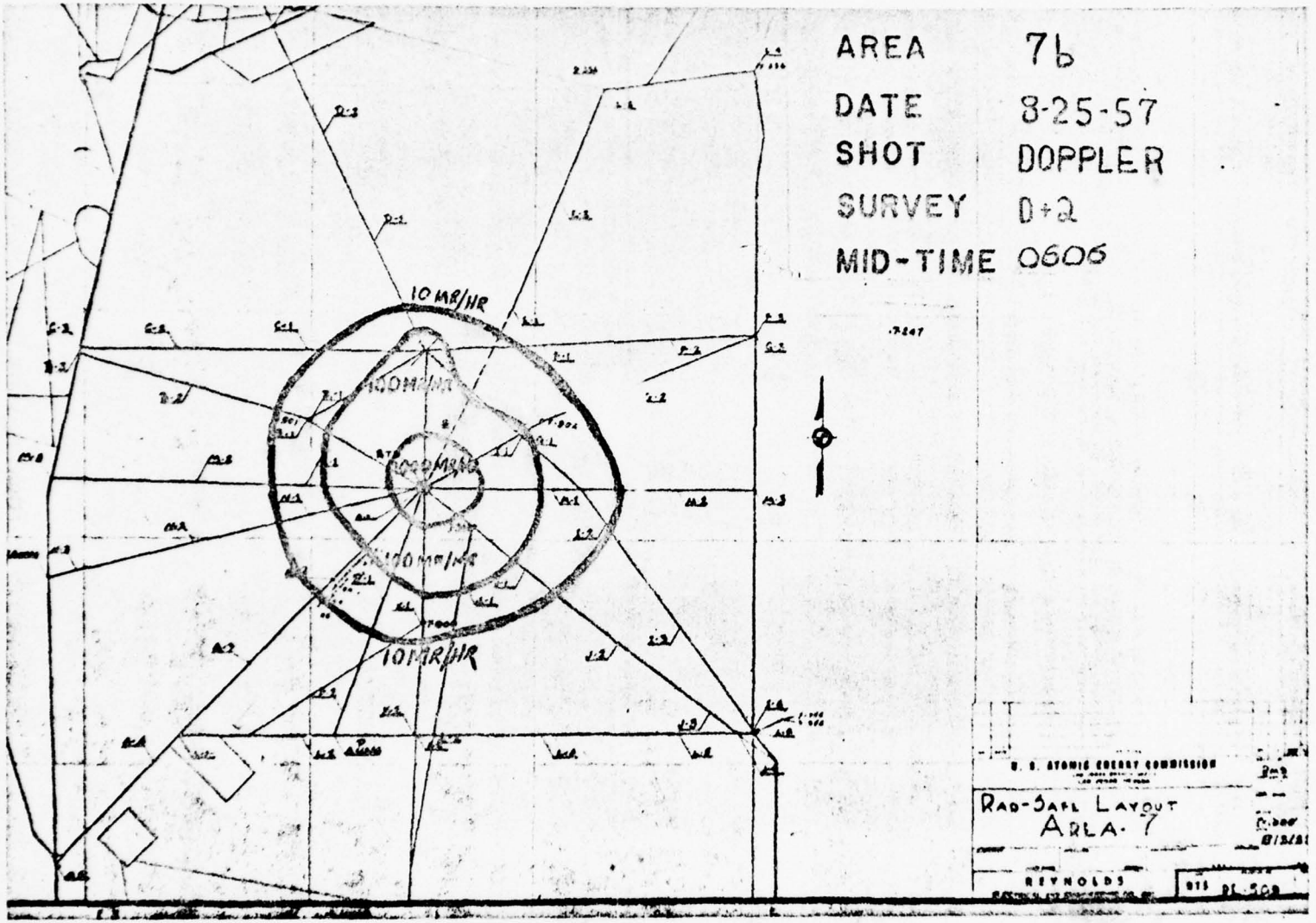

Figure 3.18.4 Doppler, D + 2

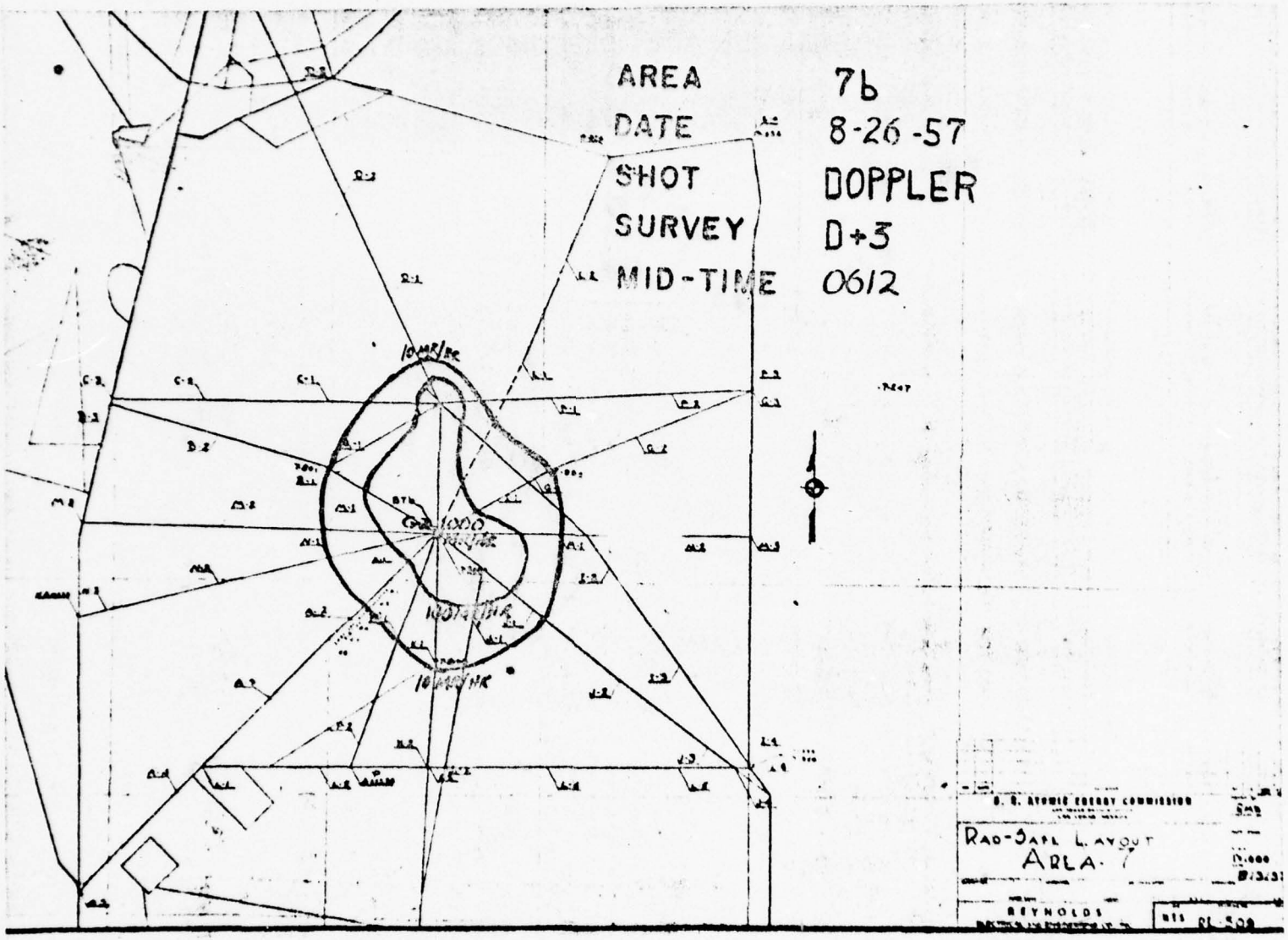

Figure 3.18.5 Doppler, D + 3

Fallout Trays:

Location	Long-Lived Alpha d/m per ft^2
Well 5	42
CP-2	42
Gate 385	34
Area 13	Background
Gate 120	Background
Shot Area (Average)	30

No increase in radioactivity was noted in well and drinking water.

Radiation surveys in the "clean working and living areas" of Mercury and the CP Area were negative.

Film badges placed prior to the detonation indicated the following exposures:

Location	Exposure mr	Total Exposure Time days
Gate 385	260	4
Area 13	120	4

The following samples were analyzed in the laboratory:

Type	Number
Air Samples	118
Nasal Swabs	32
Surface Swipes	128
Fallout Trays	175
Water Samples	19
Total	472

3.18.5 Training Branch

A one-hour Rad-Safe lecture was given to 35 FCDA observer personnel on August 27.

3.18.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
Aug. 22	191	260
Aug. 23	139	253
Aug. 24	137	253
Aug. 25	77	119
Aug. 26	914	600

Date	Issued	Processed & Recorded
Aug. 27	976	1338
Aug. 28	553	745
Totals	2987	3568

Dosimeters:

Date	Issued	Received
Aug. 22	66	40
Aug. 23	23	23
Aug. 24	19	17
Aug. 25	15	15
Aug. 26	22	22
Aug. 27	25	25
Aug. 28	10	10
Totals	180	149

3.18.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 1260 people as follows:

Item	Number
Coveralls	325
Shoe Covers (pairs)	1129
Respirators	101
Other Items	859

The laundry processed 4421 pieces of anti-contamination items.

3.19 Pascal "B" (August 27, 1957)

Pascal "B" was a device fired in Area U3d. The device was detonated at 1535 hours on August 27, 1957. It was the fifth safety experiment of the Plumbbob series.

3.19.1 General Monitoring Branch

Four monitors performed an initial survey at H / 5 minutes. Results of the survey indicated background levels of beta-gamma radiation and a maximum of 300 c/m/55cm^2 of alpha activity at one location. The area was posted with alpha radiation signs and a check station was operated at 3-300 Bunker to aid recovery parties. No re-surveys of the site were performed due to the low level of contamination encountered in the initial survey.

3.19.2 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
Aug. 27	25	25
Total	25	25

Dosimeters:

Date	Issued	Received
Aug. 27	25	25
Total	25	25

3.19.3 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 18 people as follows:

Item	Number
Coveralls	18
Shoe Covers (pairs)	18
Respirators	18
Other Items	94

3.20 Franklin Prime (August 29 through August 30, 1957)

Franklin Prime was a device fired from a balloon suspended 750 feet above Area 7b. The device was detonated at 0540 hours on August 30, 1957. The mushroom top of the cloud rose above 30,000 feet MSL. The cloud was blown north-northeast from the Test Site at approximately 30 knots. The stem drifted slowly to the west of north from the detonation point.

3.20.1 General Monitoring Branch

The aerial survey team departed at 0650 hours. The results obtained from this survey were as follows:

Intensity r/hr	Location	Altitude feet	Time hours	Area
22	7b	500	0658	7

Subsequent aerial re-surveys at an altitude of 200 feet provided the following measurements:

Intensity r/hr	Location	Time hours	Area	Re-survey days
22	7b	1145	7	D-day
3	Greenhouse	1150	7	D-day

The D / 1, D / 2 and D / 3 days aerial re-surveys were cancelled. Sufficient readings were obtained from ground surveys.

The initial ground survey teams departed at 0545 hours.

The results of the ground survey of non-shot areas were as follows:

Intensity mr/hr	Location	Time hours	Area
Background	Well 3	0549	Yucca Flat
Background	Area 3b GZ	0553	3
Background	Area 1 GZ	0605	1
As Posted (Aug. 25)	Area 2 GZ	0628	2

Check stations to control access into the contaminated areas were established on the access roads to Areas 3, 7, 8 and 9.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
Aug. 30	D / 1/4	1153
Sept. 1	D / 2	0621
Sept. 2	D / 3	0901
Sept. 4	D / 5	0613
Sept. 7	D / 8	0609

There was no D / 1 survey made due to the widespread contamination from the Smoky detonation on August 31.

3.20.2 Plotting and Briefing Branch

Results of the surveys were plotted for display at various locations. (Figures No. 3.20.1 through 3.20.4).

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
Aug. 29	45	11	113
Aug. 30	37	14	124
Totals	82	25	237

3.20.3 Decontamination Branch

The following items were decontaminated at the CP-6:

Equipment	Number
Vehicles	10

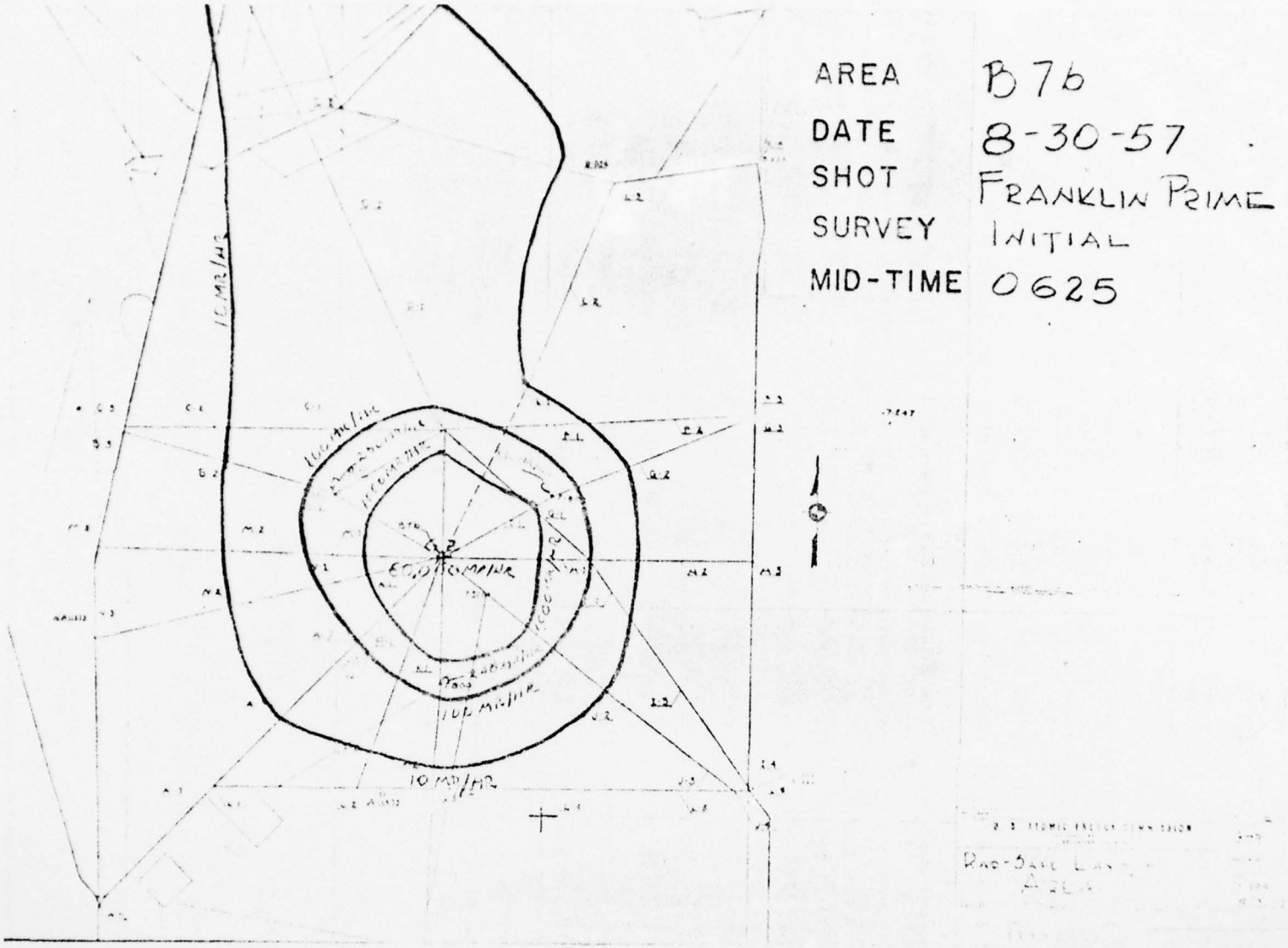

Figure 3.20.1 Franklin Prime, Initial

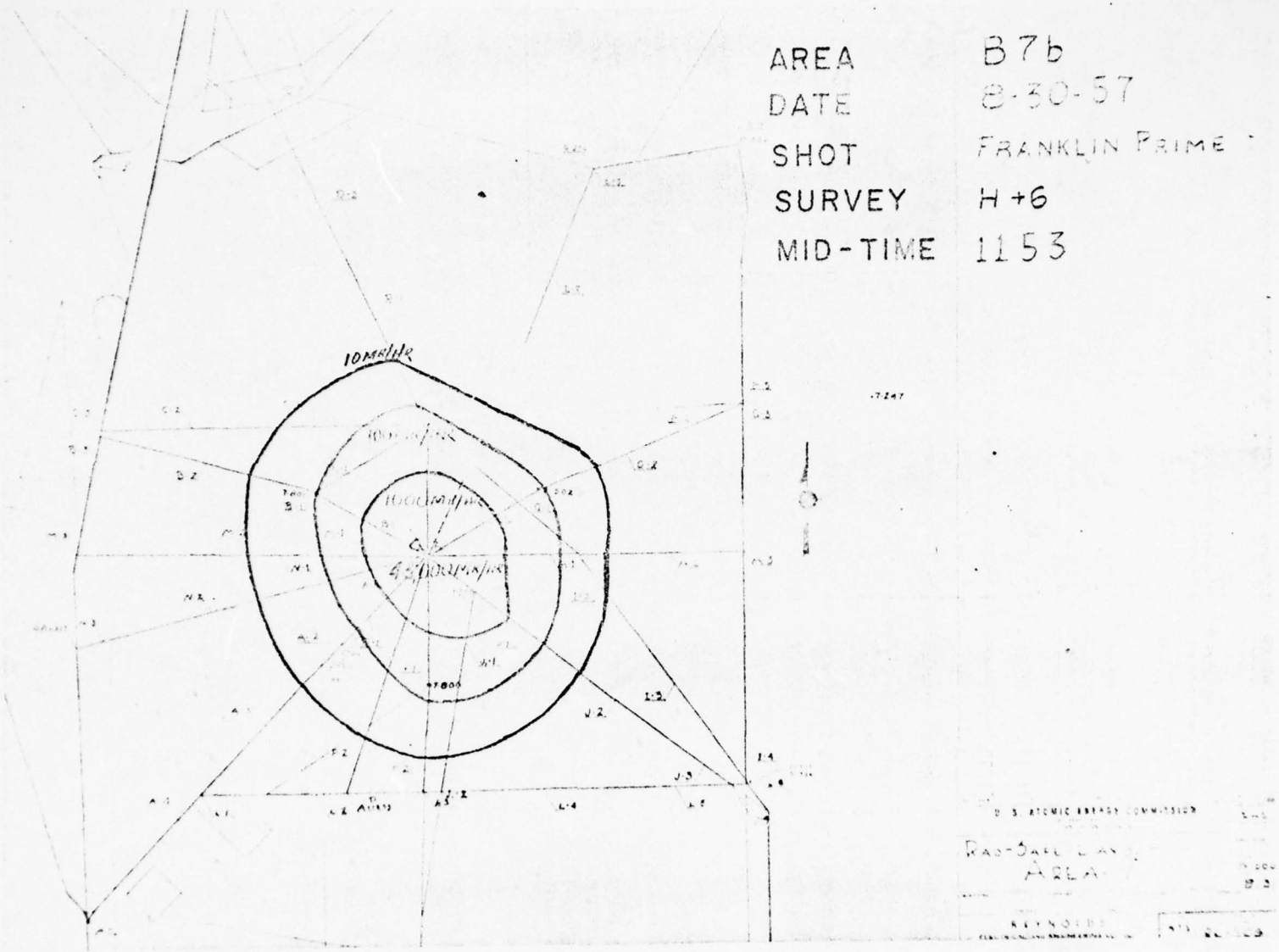

Figure 3.20.2 Franklin Prime, H + 6

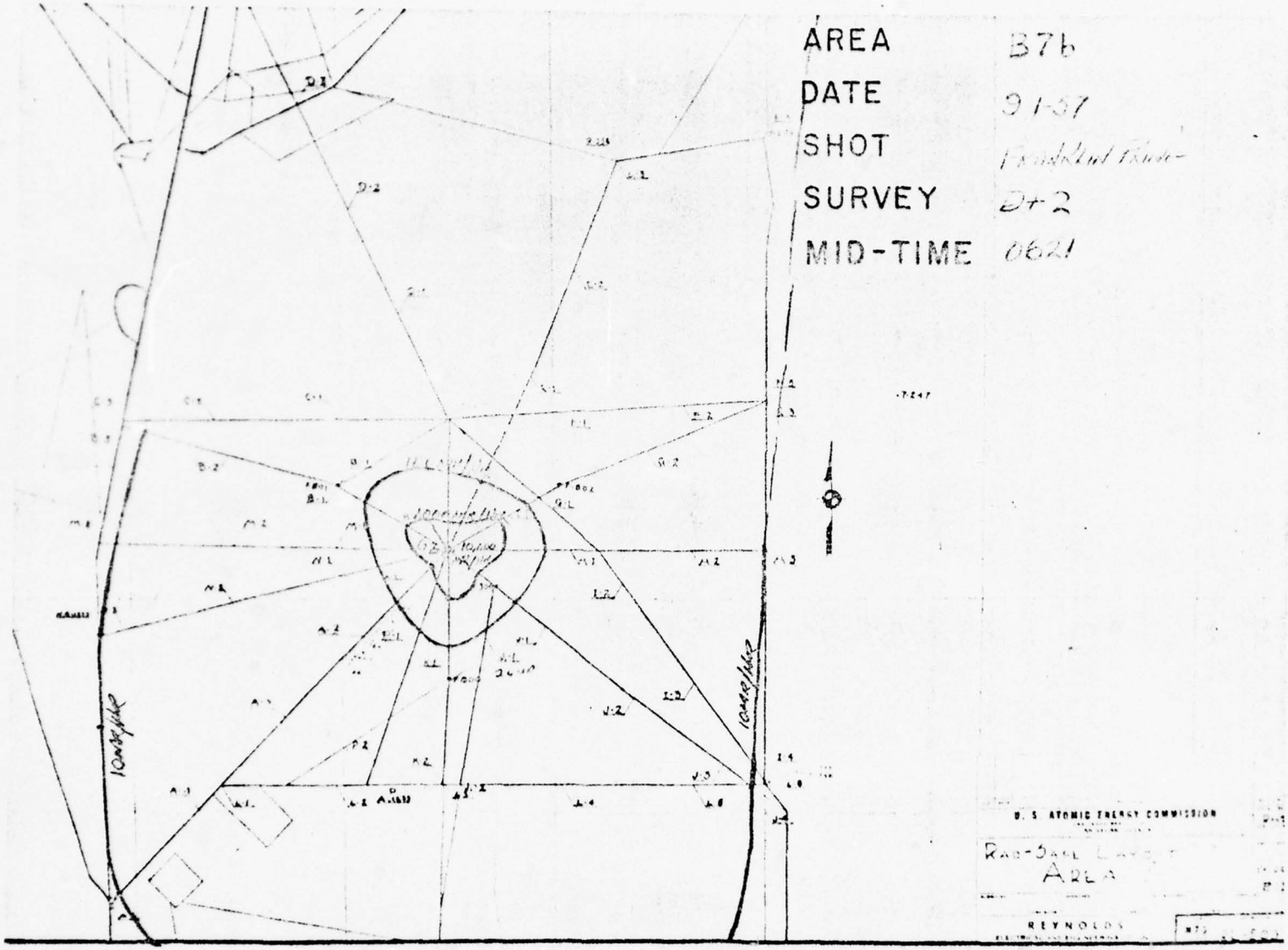

Figure 3.20.3 Franklin Prime, D + 2

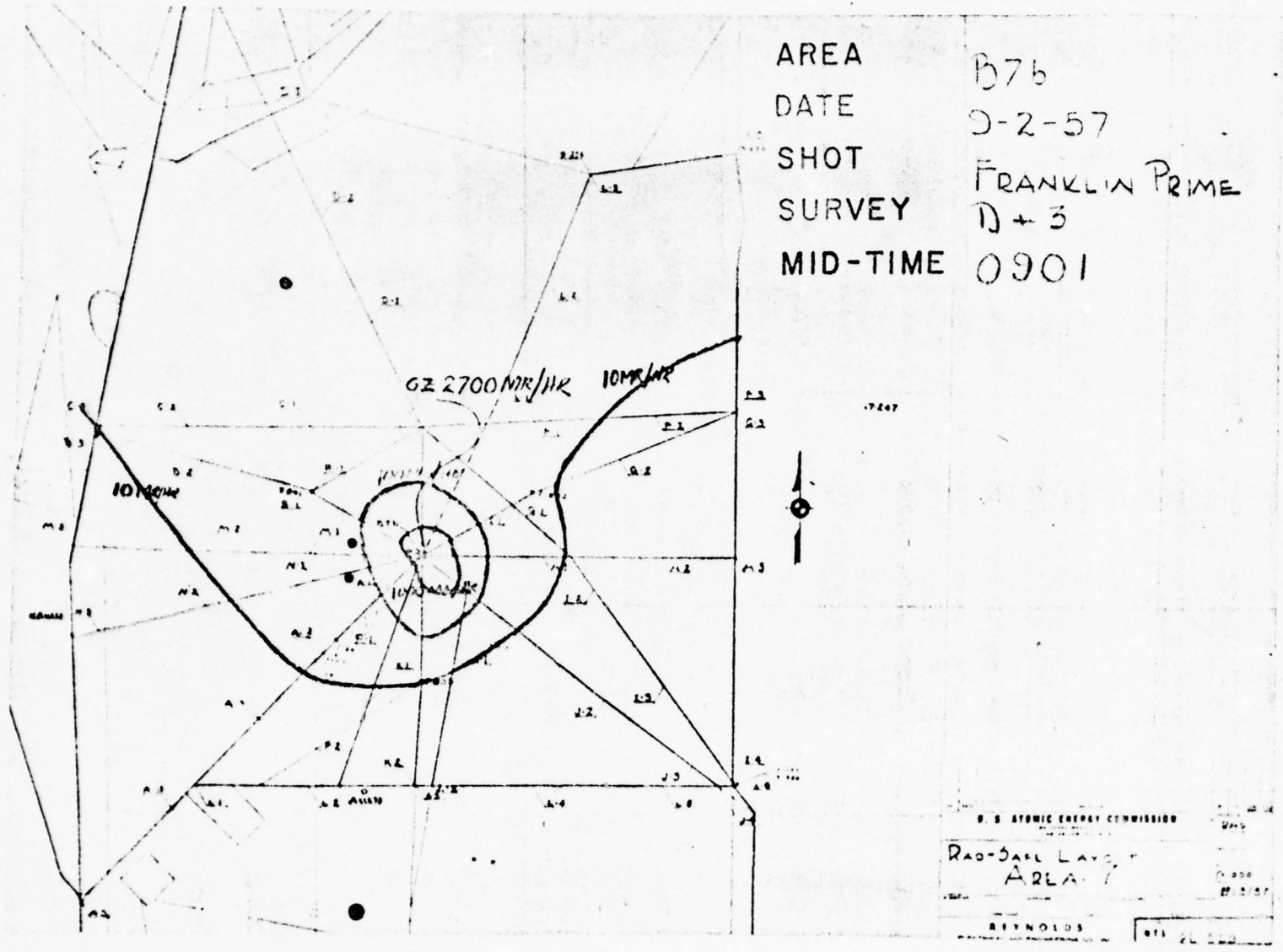

Figure 3.20.4 Franklin Prime, D + 3

3.20.4 Special Assignments Branch

The following radioactive material was monitored and cleared for release from the Nevada Test Site:

Material	No. of Boxes	Agency
Raripactor	1	Sandia Corp.

There were no significant radiation levels encountered on the highway between the CP Area and Mercury after the detonation.

Air-borne Radioactivity (D-day Averages):

Air Samples:

Location	Long-Lived Alpha d/m per M^3
Warehouse 6	Background
CP-2	Background
Gate 385	Background
Area 13	Background

Fallout Trays:

Location	Long-Lived Alpha d/m per ft^2
Warehouse 6	17
CP 2	17
Area 2	17
Gate 385	59
Area 13	17
Shot Area (Average)	16

The following samples were analyzed in the laboratory:

Type	Number
Air Samples	4
Nasal Swabs	5
Fallout Trays	30
Total	39

3.20.5 Training Branch

Routine duties were performed by the Training Branch

3.20.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
Aug. 29	465	489

Date	Issued	Processed & Recorded
Aug. 30	444	618
Totals	909	1107

Dosimeters:

Date	Issued	Received
Aug. 29	27	27
Aug. 30	52	52
Totals	79	79

3.20.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 140 people as follows:

Item	Number
Coveralls	33
Shoe Covers (pairs)	109
Respirators	20
Other Items	87

The laundry processed 936 pieces of anti-contamination items.

3.21 Smoky (August 31 through September 1, 1957)

Smoky was a device fired from a 700-foot tower in Area 8. The device was detonated at 0530 hours on August 31, 1957. The cloud rose above 35,000 feet MSL penetrating slightly through the tropopause. The cloud top was blown toward the east at about 48 knots, with lower segments moving more slowly in a more south-easterly direction. The shear produced a fairly wide diffusion of the cloud segments, thereby spreading out the fallout pattern.

3.21.1 General Monitoring Branch

The aerial survey team departed at 0820 hours. Results obtained from this survey were as follows:

Intensity mr/hr	Location	Altitude feet	Time hours
2	BJY	50	0826
40	9-300	50	0831
1	Gate 385	50	0837

Subsequent aerial re-surveys indicated the following readings:

Intensity r/hr	Location	Altitude feet	Time hours	Re-survey days
20.0	Area 7b GZ	50	1314	D-day
0.15	9-356	50	1315	D-day
0.9	Area 9 GZ	50	1317	D-day
200.0	Area 2c GZ	500	1323	D-day ←
0.2	Area 9 GZ	25	0657	D + 1
5.0	Area 7b GZ	25	0652	D + 1
0.1	9-356	25	0653	D + 1
15.0	Area 2c GZ	500	0700	D + 1 ←
50.0	Area 2c GZ	300	0701	D + 1 ←

The initial ground survey teams departed at 0870 hours. Results of the ground survey of non-shot areas were as follows:

Intensity mr/hr	Location	Time hours	Area
Background	BJY	0551	Yucca Flat
Background	Well 3	0558	Yucca Flat
360	Junction, Area 2 & Area 12 Roads	0615	Yucca Flat
160	BJY	0711	Yucca Flat
150	BJY	0729	Yucca Flat
42	CETG Shelters	0705	2
580	Station 353	0715	Yucca Flat
600	Station 52	0716	Yucca Flat
60	Junction, Area 3 Access Road & Mercury Highway	0805	3
100	Area 3b GZ	0808	3

A check station to control access into the contaminated areas was established at the BJY.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
Aug. 31	D + 1/3	1309 ←
Sept. 1	D + 1	0628 ←

There were two monitors provided for projects and REECO support.

3.21.2 Plotting and Briefing Branch

Results of the surveys were plotted for display at various locations. (Figures No. 3.21.1 through 3.21.4).

Briefings were conducted and area access permits were certified for each party as follows:

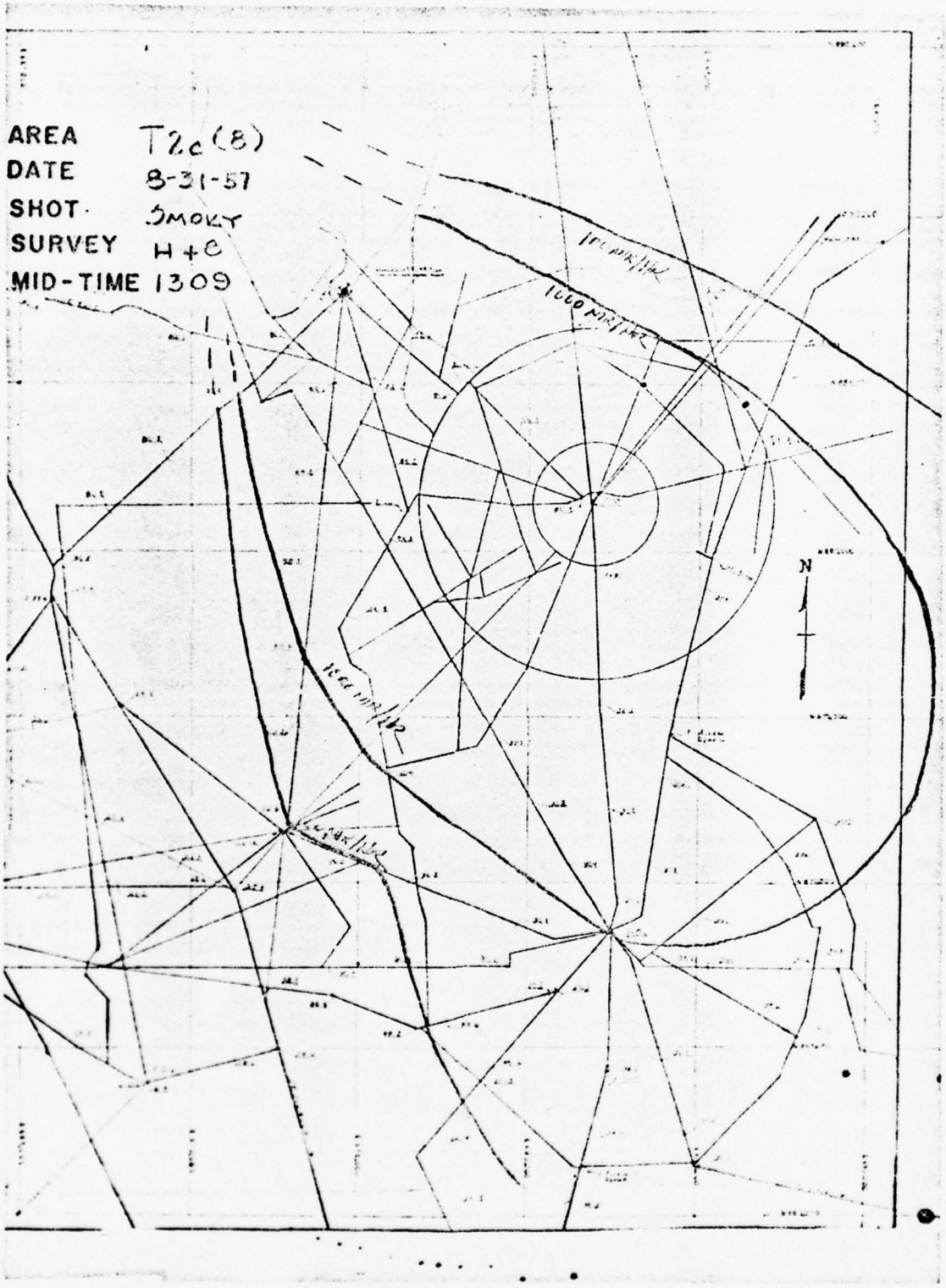

Figure 3.21.1 Smoky, H + 8

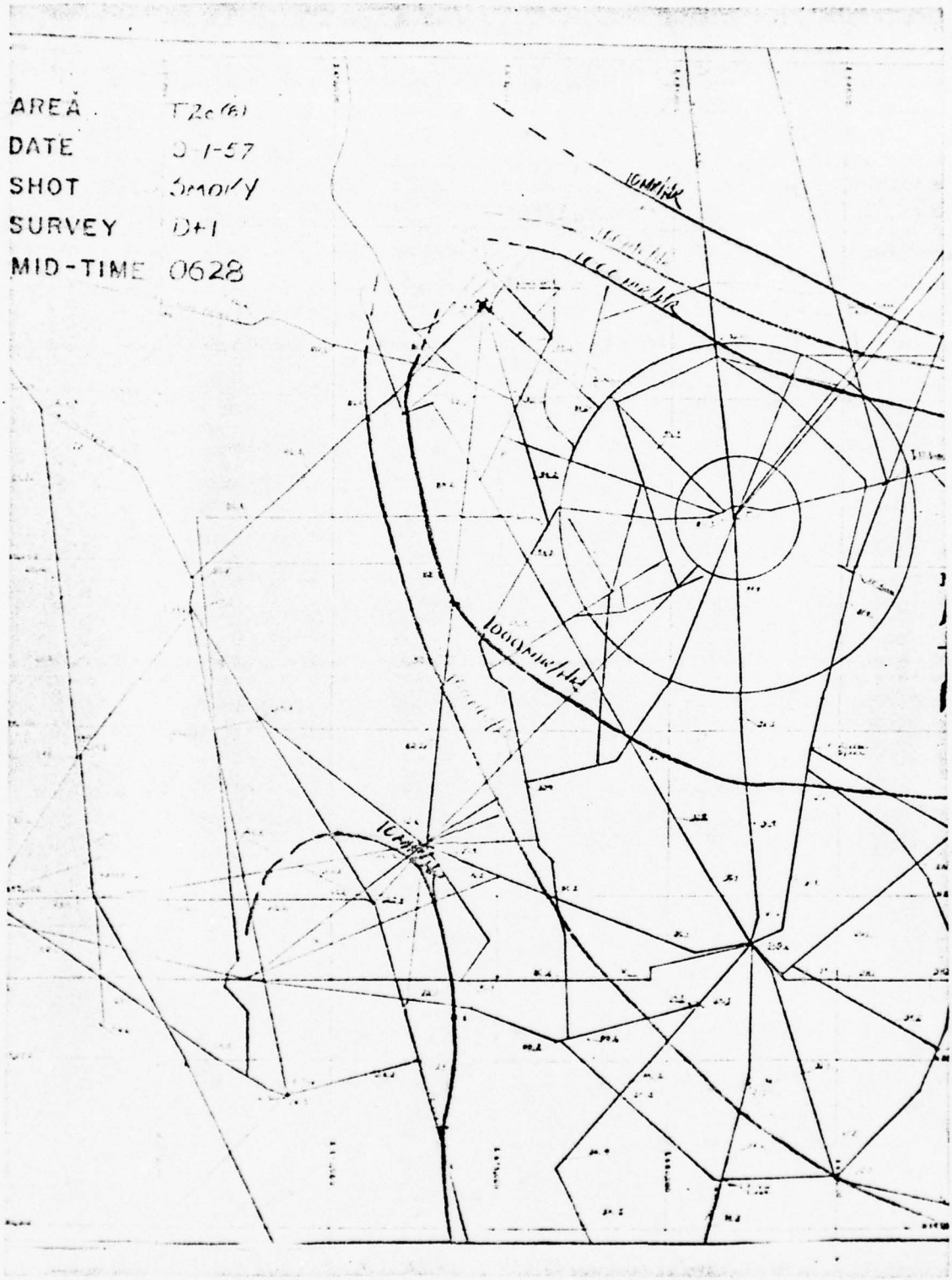

Figure 3.21.2 Smoky, D + 1

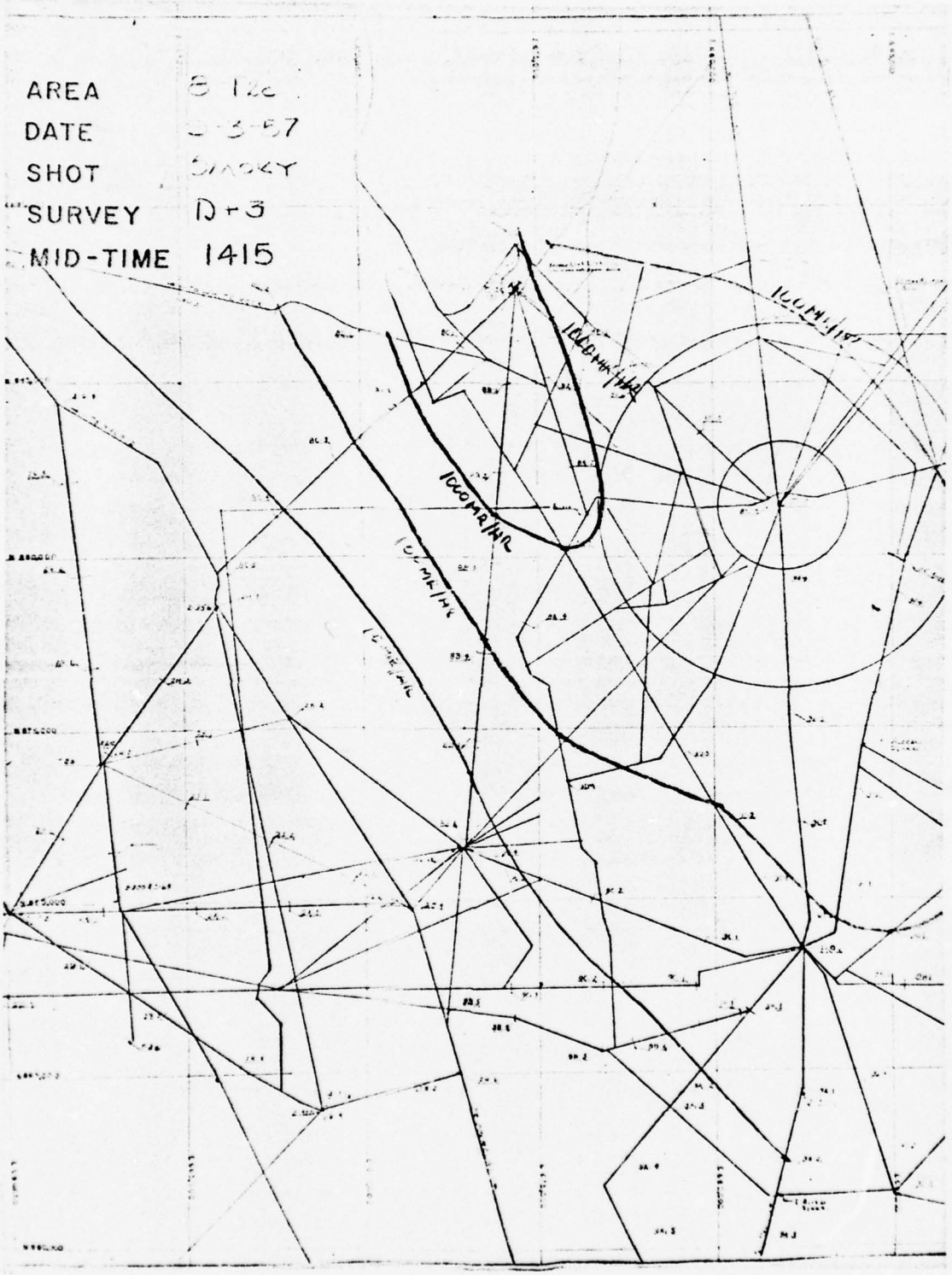

Figure 3.21.3 Smoky, D + 3

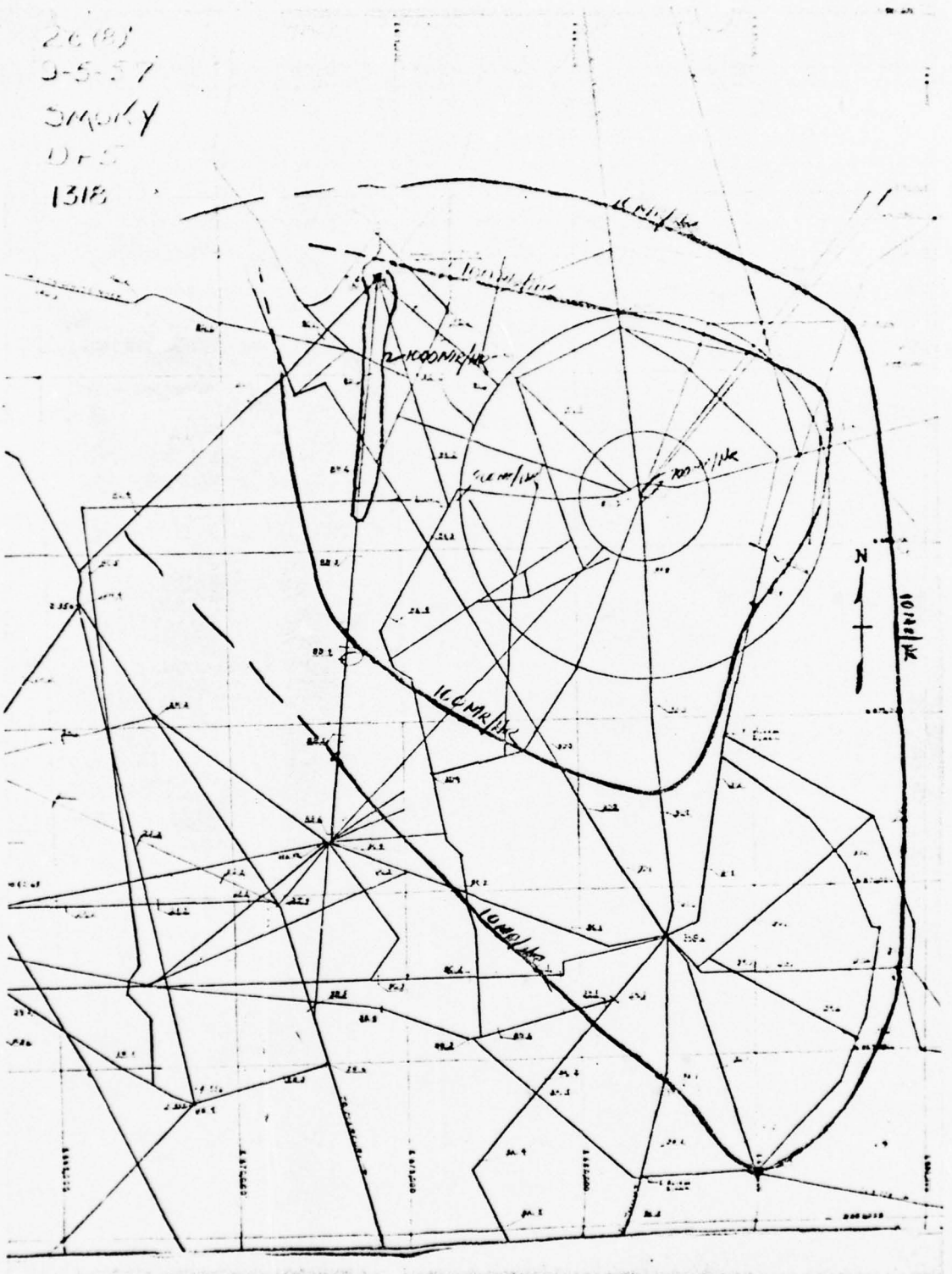

Figure 3.21.4 Smoky, D + 5

Date	Scheduled Parties	Projects Involved	Personnel Involved
Aug. 31	34	12	148
Sept. 1	18	13	47
Totals	52	25	195

3.21.3 Decontamination Branch

The following items were decontaminated at the CP-6:

Equipment	Number
Vehicles	48
Bulldozers	2

3.21.4 Special Assignments Branch

There was no detectable increase in beta-gamma activity in Area 13 and Mercury following the detonation.

Surface contamination intensities obtained in the CP-2 area indicated a maximum of 11 mr/hr at H + 4 hours.

Air-borne Radioactivity (D-day Averages):

Air Samples:

Location	Long-Lived Alpha d/m per M^3
Warehouse 6	Background
Well 5B	Background
CP-2	0.1
Gate 385	Background
Area 13	0.1
Gate 120	Background
Shot Area (Average)	16

Fallout Trays:

Location	Long-Lived Alpha d/m per ft^2
Warehouse 6	Background
Well 5B	Background
CP-2	Background
Gate 385	Background
Area 13	Background
Gate 120	Background
Shot Area (Average)	16

No increase in radioactivity was noted in well and drinking water samples.

Radiation surveys in "clean working and living areas" in Mercury and the CP Area were negative.

The following samples were analyzed in the laboratory:

Type	Number
Air Samples	46
Nasal Swabs	20
Fallout Trays	97
Surface Swipes	21
Total	184

3.21.5 Training Branch

Routine duties were performed by the Training Branch.

3.21.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
Aug. 31	137	328
Sept. 1	457	442
Totals	594	770

Dosimeters:

Date	Issued	Received
Aug. 31	102	102
Sept. 1	55	55
Totals	157	157

3.21.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 296 people as follows:

Item	Number
Coveralls	233
Shoe Covers (pairs)	313
Respirators	124
Other Items	375

The laundry processed 1254 pieces of anti-contamination items.

3.22 Galileo (September 2 through September 4, 1957)

Galileo was a device fired from a 500-foot tower in Area 1. The device was detonated at 0540 hours on September 2, 1957. The cloud top rose to above 37,000 feet MSL. Because of the near calm winds at most altitudes, it appeared to hover motionless for a considerable period. It also appeared that the mushroom top separated rather cleanly from the stem with less dirt and debris being sucked up through the radioactive top than is usual with tower shots. One result was that the orange color of the cloud top spread slowly in the general direction of the Control Point.

3.22.1 General Monitoring Branch

The aerial survey team departed at 0310 hours. Results obtained from this survey were as follows:

Intensity r/hr	Location	Altitude feet	Time hours	Area
50	Area 1 GZ	500	0815	1
5	1-390	500	0820	1
1.5	7-300	25	0825	7
1	Junction, Area 2c Access Road & Area 10 Perimeter Road	50	0830	8
1	Phantom Pad	50	0832	8
1	French & German Shelters	50	0834	3
7	Area 2c GZ	500	0840	8
9	Area 2c GZ	300	0844	8

Subsequent aerial re-surveys indicated the following readings:

Intensity r/hr	Location	Altitude feet	Time hours	Area	Re-survey days
22	Area 1 GZ	200	0915	1	D / 1
52	Area 1 GZ	100	0915	1	D / 1
12	Area 2c GZ	50	0925	8	D / 1
10	French & German Shelters	25	0928	8	D / 1
0.8	Junction, Area 2c Access Road & Area 10 Perimeter Road	25	0930	8	D / 1
0.8	Phantom Pad	25	0929	8	D / 1
10	Area 1 GZ	50	0910	1	D / 2
30	Area 1 GZ	25	0911	1	D / 2
15	Area 2c GZ	50	0920	8	D / 2
18	Area 2c GZ	25	0921	8	D / 2
0.9	Junction, Area 2c Access Road & Area 10 Perimeter Road	50	0923	8	D / 2
0.8	Junction, Area 2c Access Road & Area 10 Perimeter Road	25	0924	8	D / 2

The initial ground survey teams departed at 0550 hours. Results of the ground survey of non-shot areas were as follows:

Intensity mr/hr	Location	Time hours	Area
0	Well 3	0551	Yucca Flat
8	Area 3a GZ	0554	3
60	4-330	0608	4
1000	Area 4 GZ	0608	4
160	Greenhouse Pad	0717	9
40	9-300	0720	9
310	Entrance to Lower Tunnel	0700	12

A check station was established at the intersection of Area 1 access road and Mercury Highway on ' -day to control access into the contaminated areas.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
Sept. 2	D / 1/4	1150
Sept. 3	D / 1	0628
Sept. 4	D / 2	0816
Sept. 5	D / 3	0626

There were six monitors provided for projects and REECO support.

3.22.2 Plotting and Briefing Branch

Results of the surveys were plotted for display at various locations. (Figures No. 3.22.1 through 3.22.5).

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
Sept. 2	53	16	221
Sept. 3	94	13	239
Sept. 4	102	12	275
Totals	249	41	735

3.22.3 Decontamination Branch

The following items were decontaminated at the CP-6:

Equipment	Number
Vehicles	64
Recorders	2

The Area 7 Greenhouse Pad was also decontaminated.

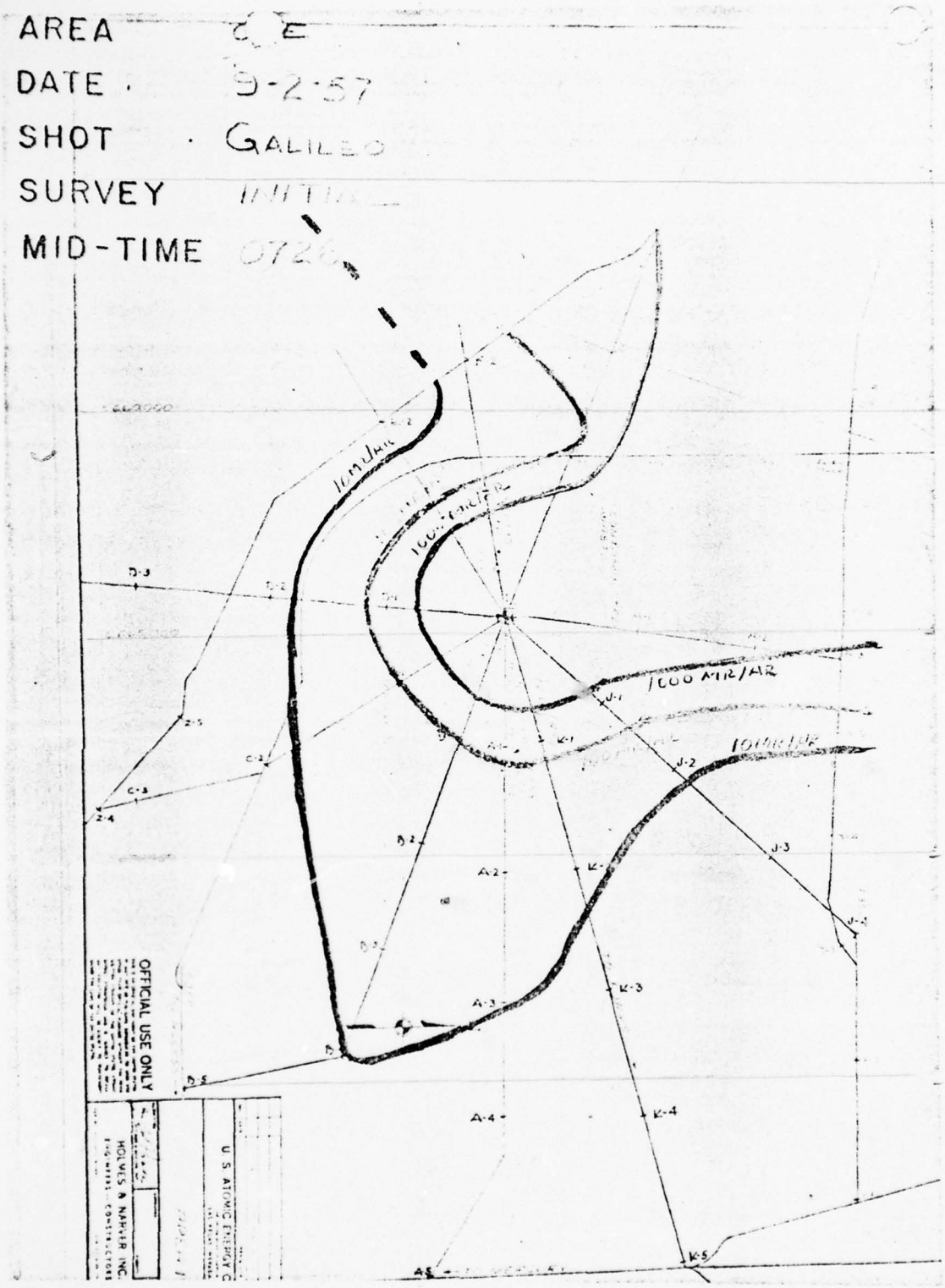

Figure 3.22.1 Galileo, Initial

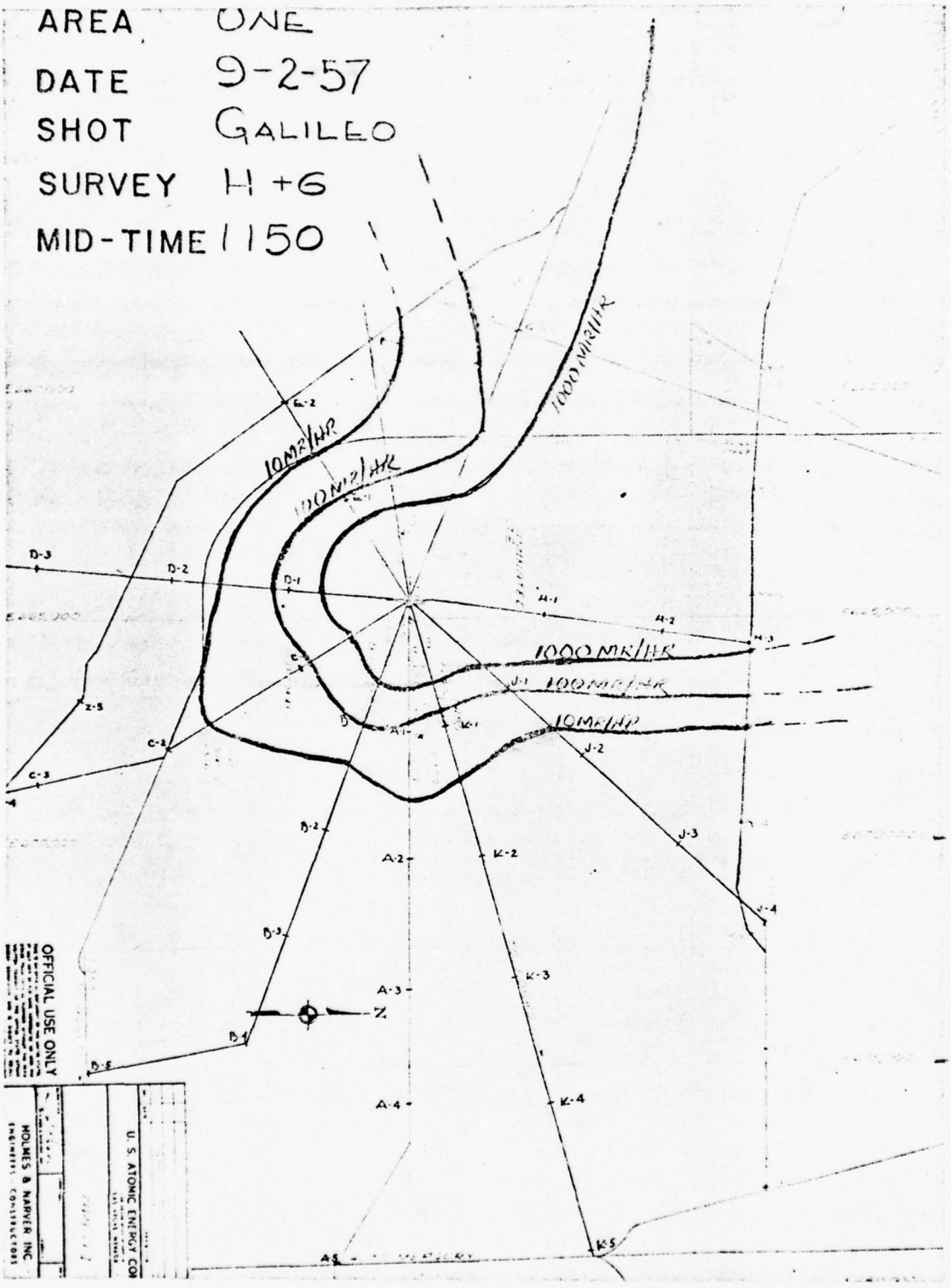

Figure 3.22.2 Galileo, H + 6

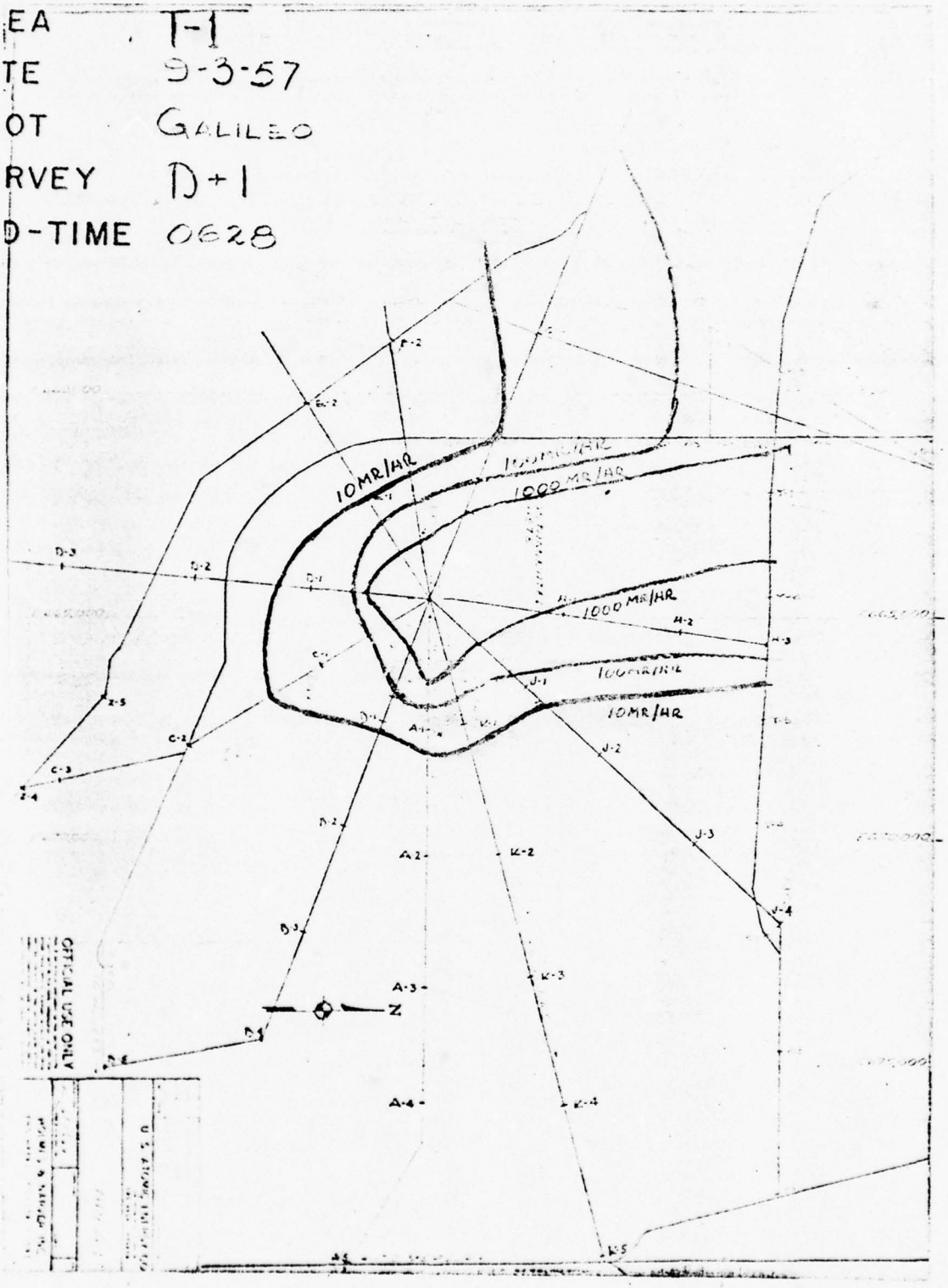

Figure 3.22.3 Galileo, D + 1

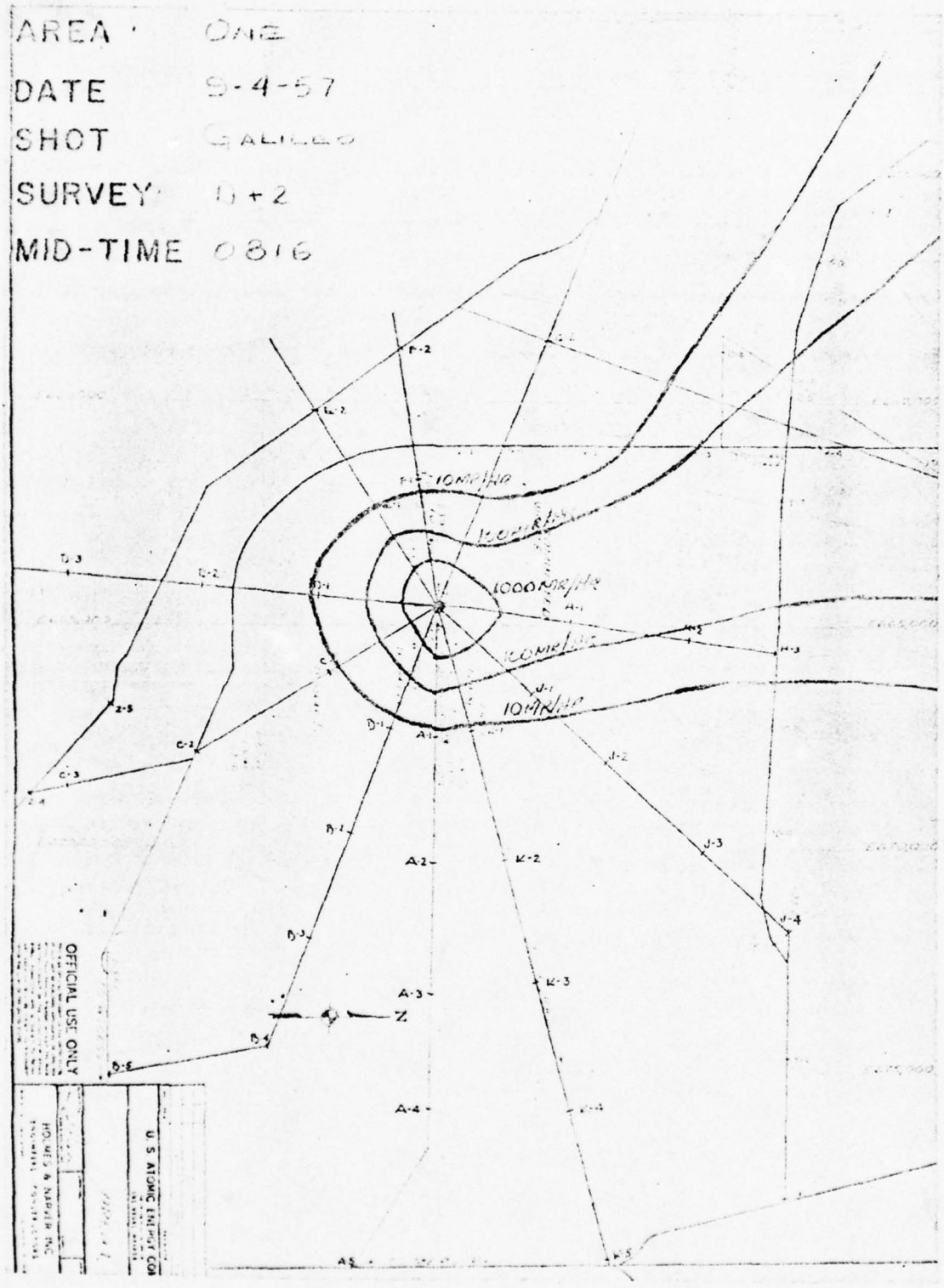

Figure 3.22.4 Galileo, D + 2

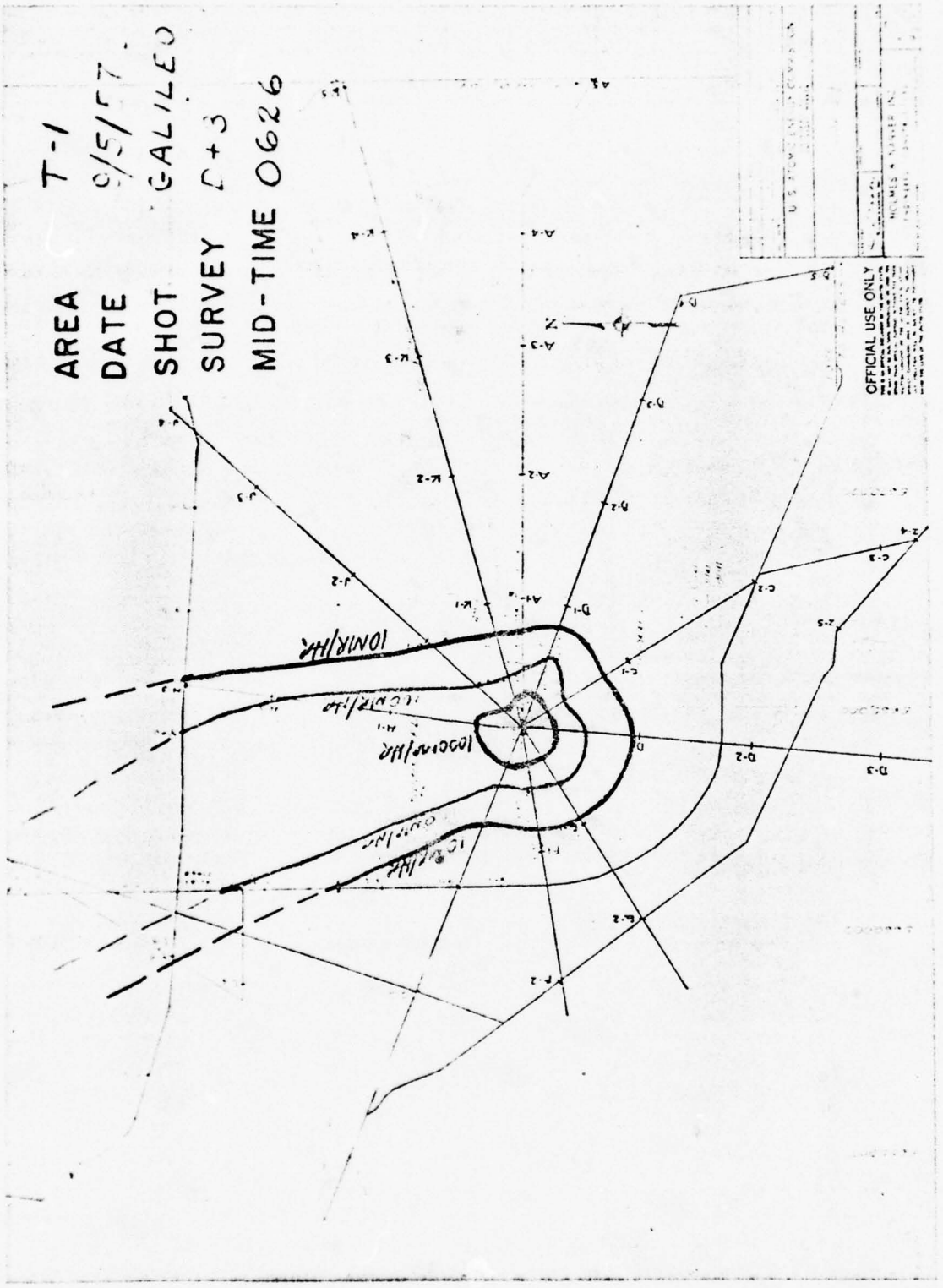

Figure 3.22.5 Galileo, D + 3

3.22.4 Special Assignments Branch

There were no increases in beta-gamma radioactivity indicated in Area 13 or Mercury following the detonation.

Surface contamination levels obtained in the CP-2 area indicated a maximum of 8.5 mr/hr at H / 3 hours.

Air-borne Radioactivity (D-day Averages):

Air Samples:

Location	Long-Lived Alpha d/m per M^3
Warehouse 6	Background
CP-2	0.1
Gate 385	Background
Area 13	0.1

Fallout Trays:

Location	Long-Lived Alpha d/m per ft^2
Warehouse 6	Background
Well 5	Background
CP-2	Background
Gate 385	Background
Area 13	Background
Shot Area (Average)	64

No increase in radioactivity was noted in well and drinking water samples.

Radiation surveys in "clean working and living areas" in Mercury and the CP Area were negative.

The following samples were analyzed in the laboratory:

Type	Number
Air Samples	34
Nasal Swabs	17
Fallout Trays	47
Surface Swipes	84
Total	182

3.22.5 Training Branch

Routine duties were performed by the Training Branch.

3.22.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
Sept. 2	2598	383
Sept. 3	457	423
Sept. 4	460	575
Totals	3515	1381

Dosimeters:

Date	Issued	Received
Sept. 2	235	230
Sept. 3	97	97
Sept. 4	116	116
Totals	448	443

On September 2, 2500 film badges were issued to the Off-Site Rad-Safe Organization.

3.22.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 881 people as follows:

Item	Number
Coveralls	444
Shoe Covers (pairs)	764
Respirators	190
Other Items	3127

The laundry processed 4912 pieces of anti-contamination items.

3.23 Wheeler (September 5 through September 6, 1957)

Wheeler was a device fired from a balloon suspended 500 feet above Area 9b. The device was detonated at 0545 hours on September 6, 1957. The detonation created the hour-glass effect, usual with balloon shots. The cloud rose above 15,000 feet MSL and was blown slowly toward west of due north from the point of detonation.

3.23.1 General Monitoring Branch

The aerial survey team departed at 0715 hours. Results obtained from this survey were as follows:

Intensity r/hr	Location	Altitude feet	Time hours	Area
0.08	7	100	0725	7

Intensity r/hr	Location	Altitude feet	Time hours	Area
3.0	Area B-9 GZ	200	0728	9
4.5	Area B-9 GZ	50	0729	9
4.8	Area B-9 GZ	25	0745	9
7.5	Area 1 GZ	25	0750	1

Subsequent scheduled aerial re-surveys were cancelled because it was possible to obtain necessary readings from ground re-surveys.

The initial ground survey teams departed at 0550 hours. Results of the ground survey of non-shot areas were as follows:

Intensity mr/hr	Location	Time hours	Area
44-50	7-300	0617	7
15	Greenhouse	0615	7
30	CETG Underground Shelter	0618	2
26	Butler Building (New)	0619	2
18	Butler Building (Old)	0620	2
38	Lower Tunnel	0637	12
35-40	Drill Rig	0700	12
1000	Intersection Area 2 Access Road & Area 10 Perimeter Road	0631	8

A check station to control access into the contaminated area was established at the BJY.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
Sept. 6	D / 1/4	1206
Sept. 7	D / 1	0745
Sept. 8	D / 2	0804
Sept. 9	D / 3	0845
Sept. 11	D / 5	0603

3.23.2 Plotting and Briefing Branch

Results of the surveys were plotted for display at various locations. (Figures No. 3.23.1 through 3.23.5).

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
Sept. 5	103	10	245
Sept. 6	59	16	198
Totals	162	26	443

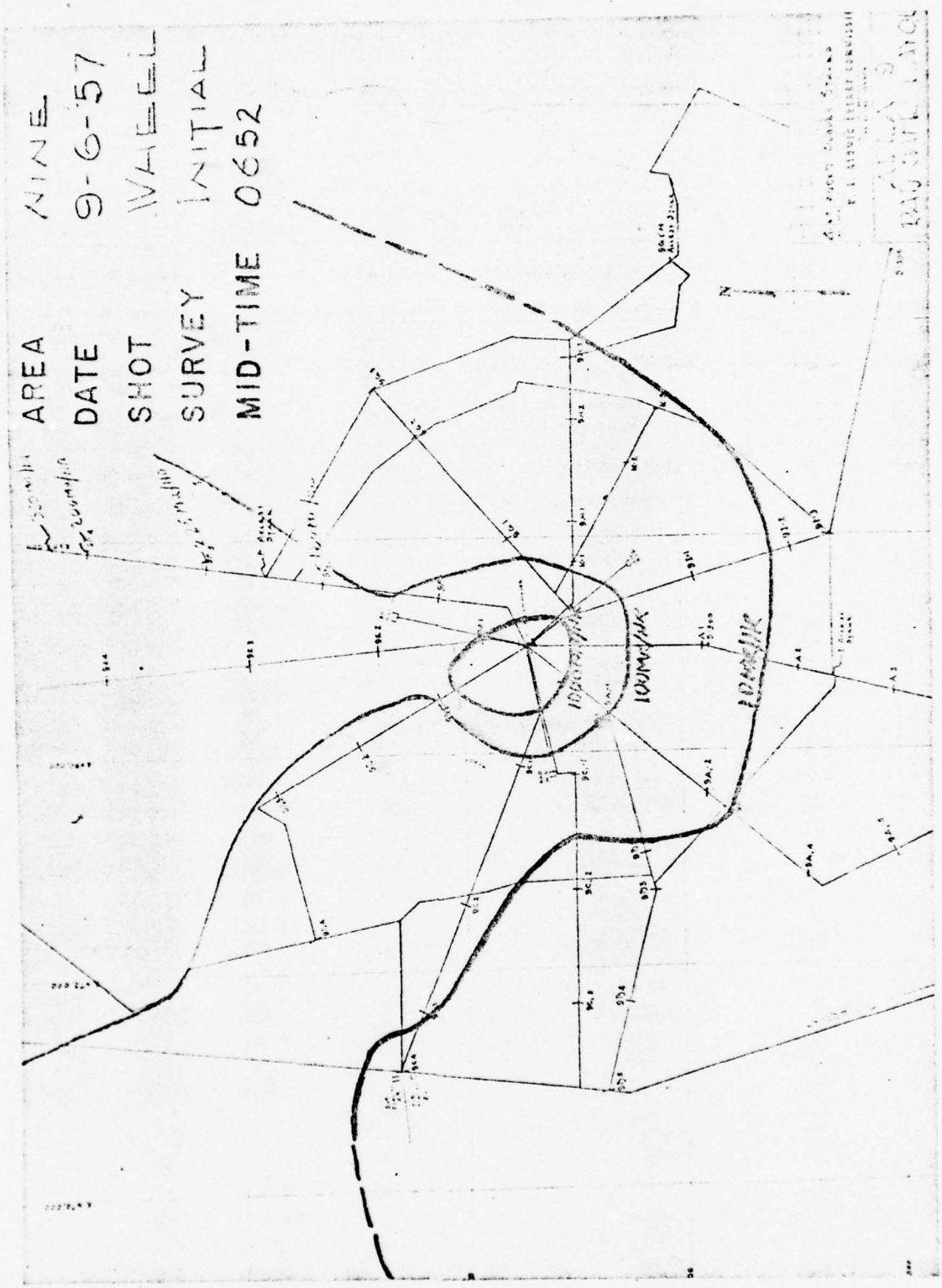

Figure 3.23.1 Wheeler, Initial

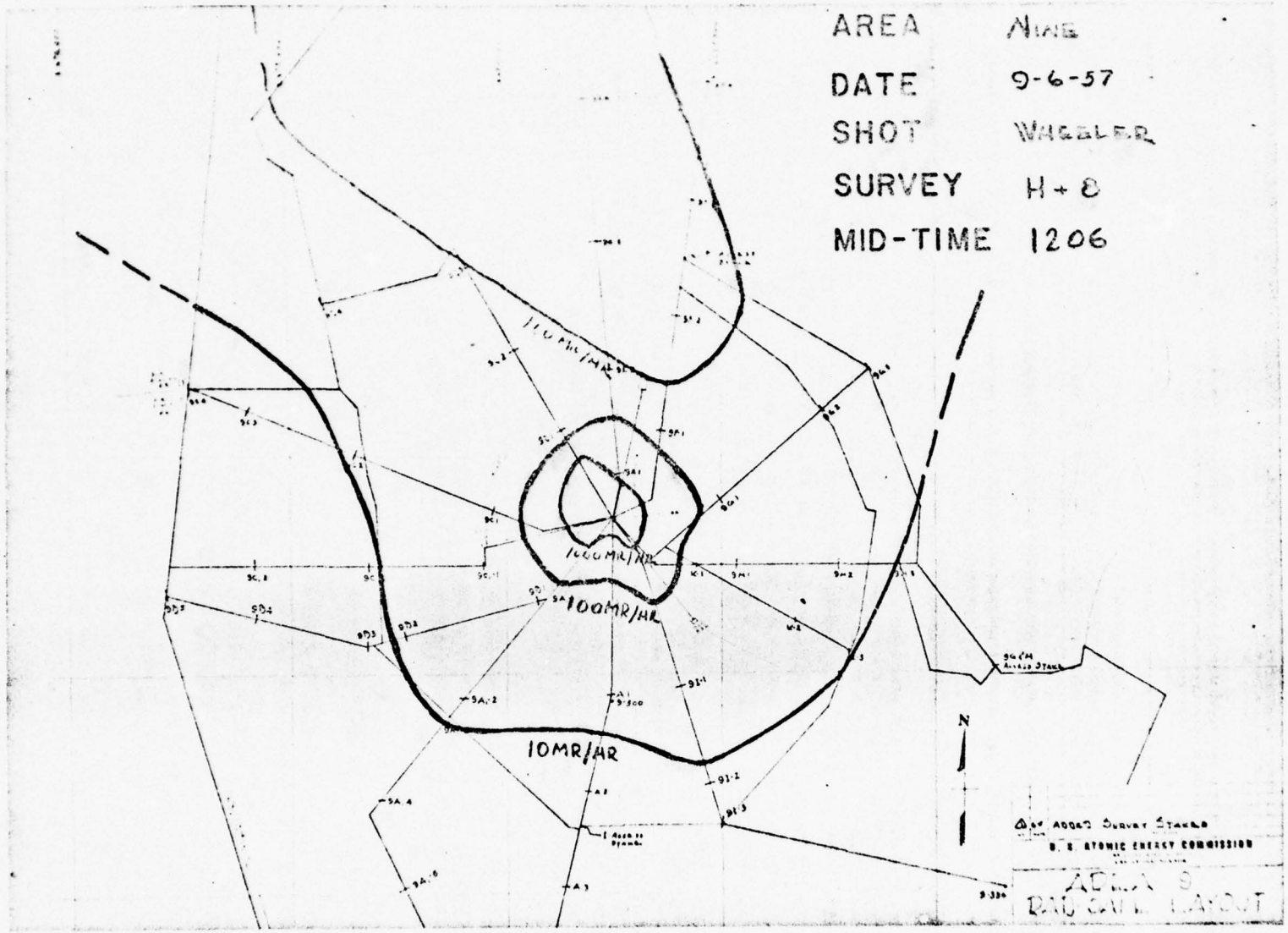

Figure 3.23.2 Wheeler, H + 8

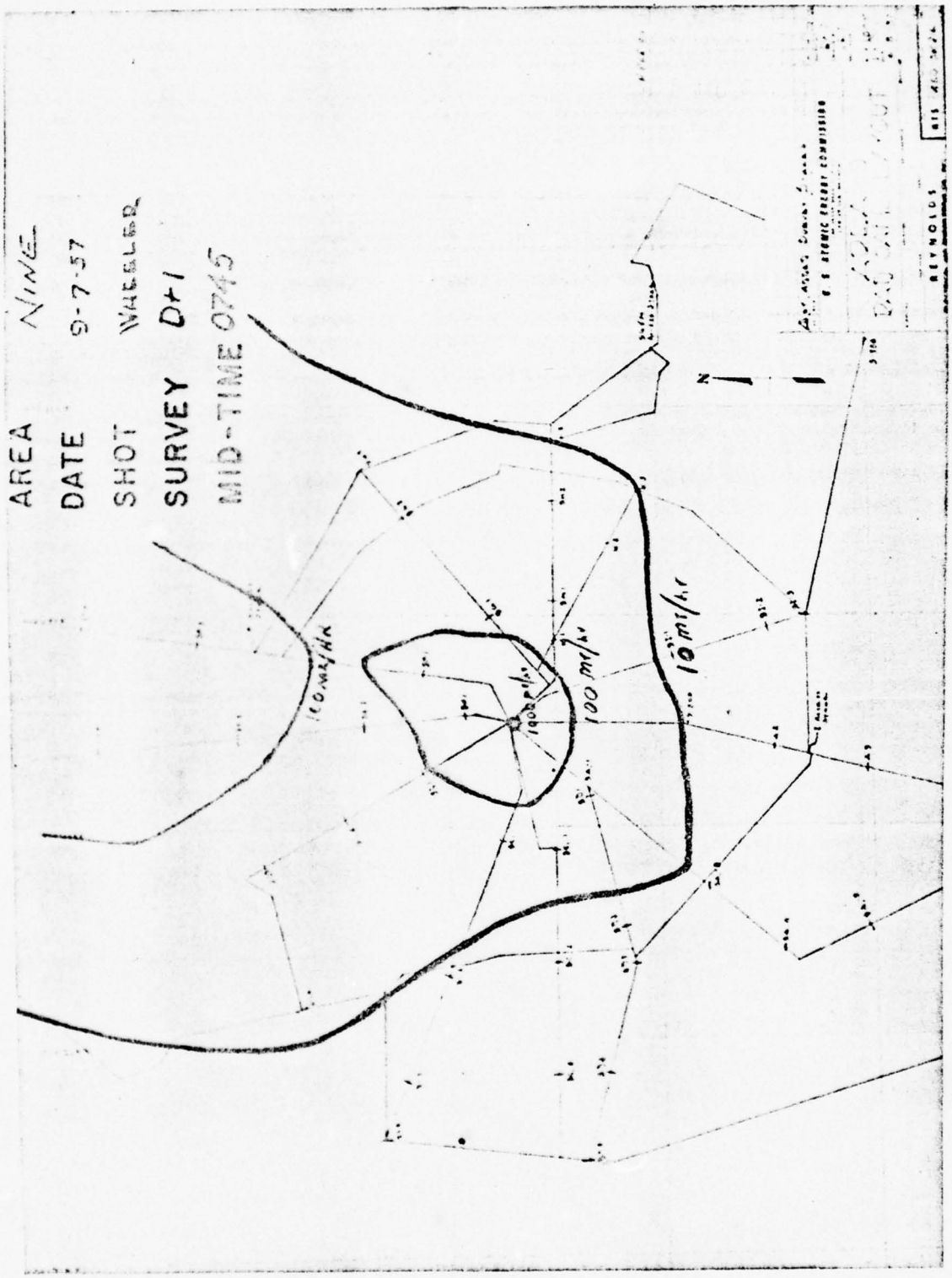

Figure 3.23.3 Wheeler, D + 1

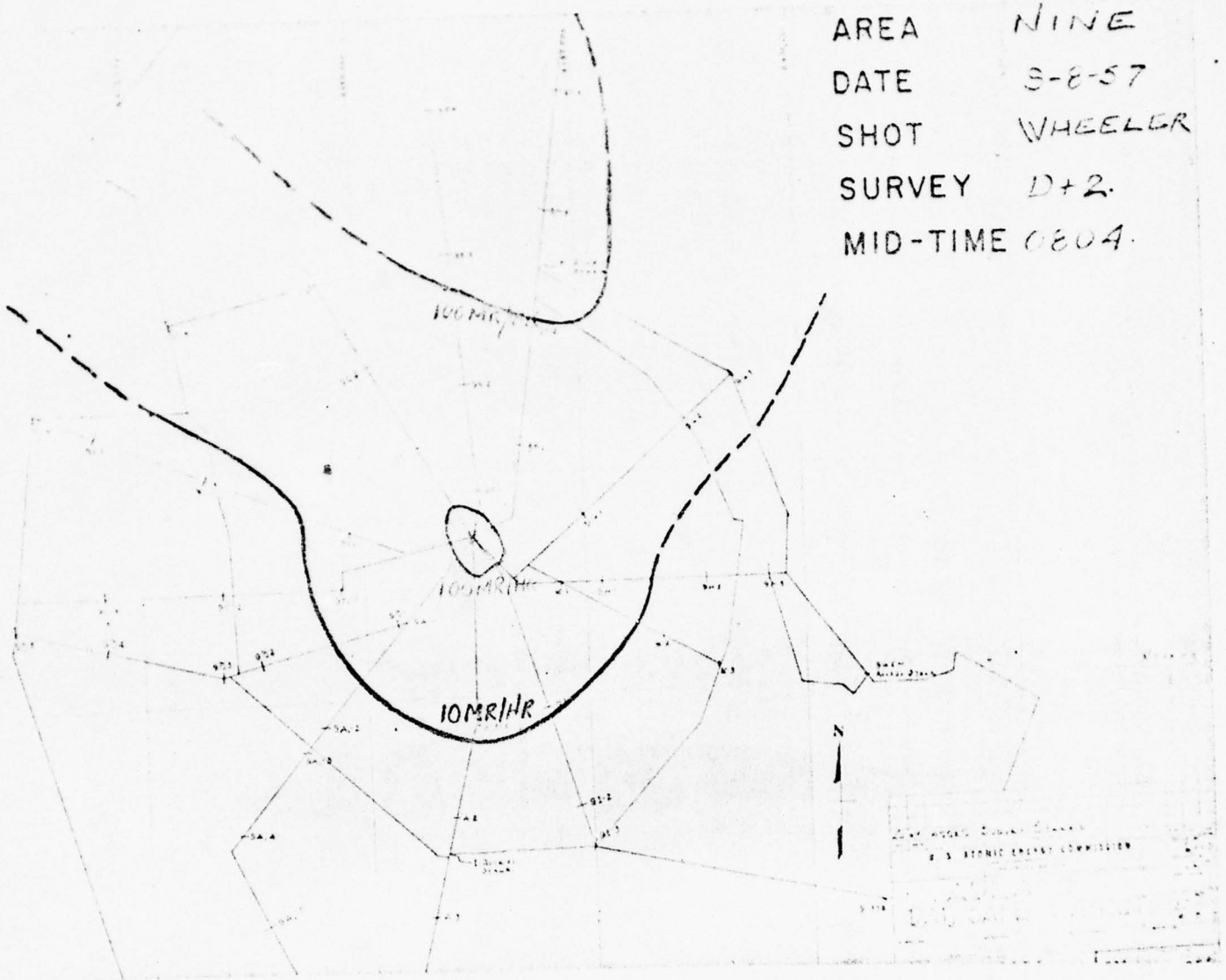

Figure 3.23.4 Wheeler, D + 2

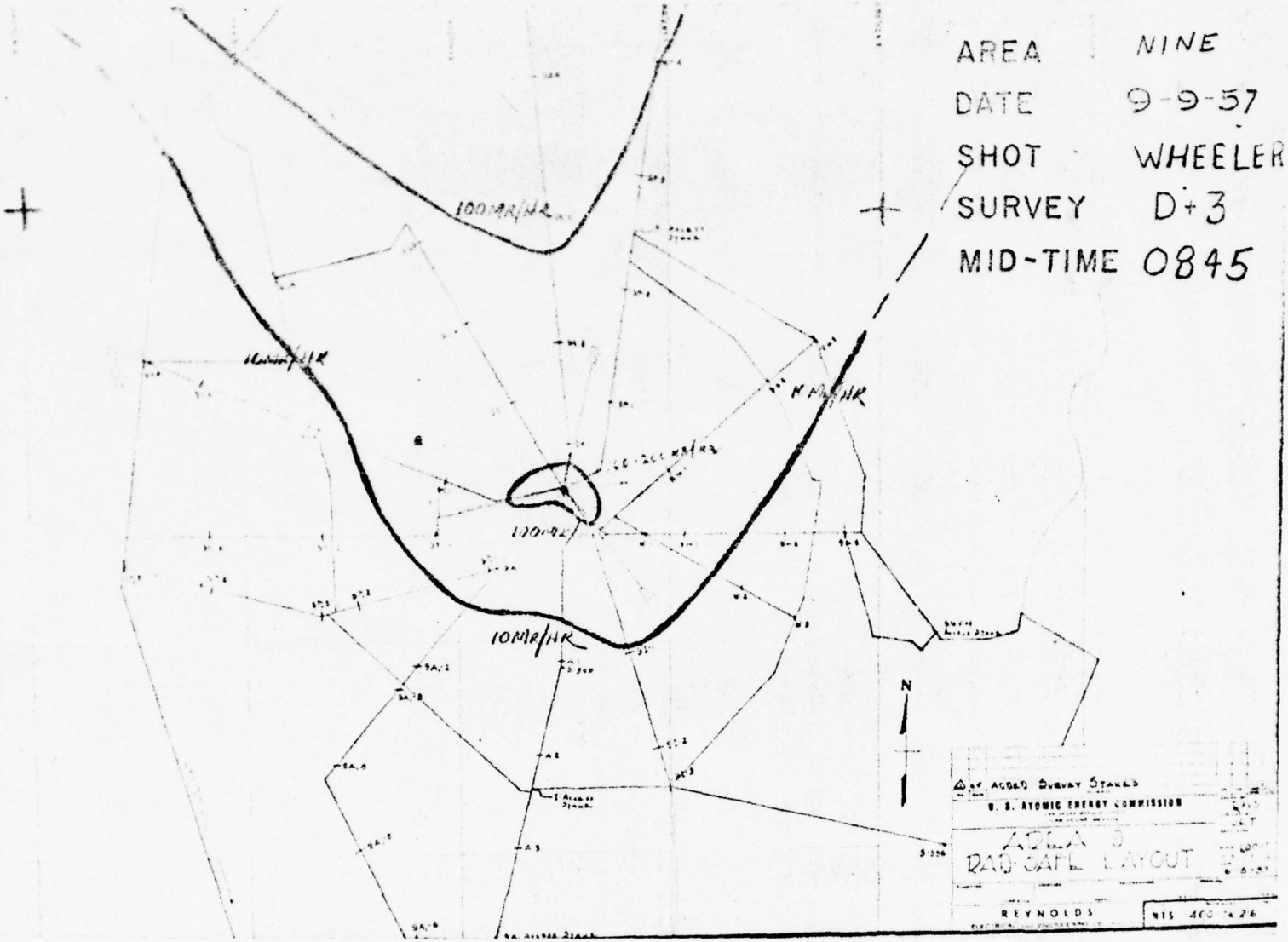

Figure 3.23.5 Wheeler, D + 3

3.23.3 Decontamination Branch

The following items were decontaminated at the CP-6:

Equipment	Number
Vehicles	58
Grader	1
High-speed Camera	1

3.23.4 Special Assignments Branch

The following radioactive material was monitored and cleared for release from the Nevada Test Site:

Material	No. of Boxes	Agency
PoBe Source (30 curie)	1	Project 39.5

No significant radiation levels were encountered on the highway between the CP-2 and Mercury after the detonation.

Air-borne Radioactivity (D-day Averages):

Air Samples:

Location	Long-Lived Alpha d/m per M^3
Warehouse 6	Background
CP-2	0.4
Gate 385	0.2
Area 13	0.1

Fallout Trays:

Location	Long-Lived Alpha d/m per ft^2
Warehouse 6	17
Well 5B	17
CP-2	Background
Gate 385	Background
Area 13	50
Shot Area (Average)	9

Continued surface contamination readings in the CP-2 area indicated a maximum of 0.15 mr/hr at H + 1 hour.

No increase in radioactivity was noted in well and drinking water samples.

Radiation surveys in "clean working and living areas" in Mercury and the CP Area were negative.

The following samples were analyzed in the laboratory:

Type	Number
Air Samples	37
Nasal Swabs	20
Fallout Trays	115
Surface Swipes	130
Facial Swipes	4
Total	306

3.23.5 Training Branch

A Rad-Safe indoctrination lecture and a tour of the CP-2 were provided for four military medical personnel on September 5.

3.23.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
Sept. 5	250	266
Sept. 6	266	448
Totals	516	714

Dosimeters:

Date	Issued	Received
Sept. 5	151	140
Sept. 6	121	131
Totals	272	271

3.23.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 613 people as follows:

Item	Number
Coveralls	208
Shoe Covers (pairs)	593
Respirators	82
Other Items	565

The laundry processed 1019 pieces of anti-contamination items.

3.24 Coulomb "B" (September 6, 1957)

Coulomb "B" was a device fired in Area S3g. The device was detonated at 1305 hours on September 6, 1957. It was the sixth safety experiment of the Plumbbob series.

3.24.1 General Monitoring Branch

Since Coulomb "B" was a nuclear detonation, the General Monitoring Branch was alerted to determine possible evacuation routes and to standby for an immediate initial survey. At 1310 hours, two monitors were dispatched north from the CP-2 on the Mercury Highway to determine the maximum intensity via that route. At the same time, two monitors were dispatched east from the BJY via the "L" road to the FCDA road; then south to the 3-355 pad; thence, west to the 3b access road; and, finally southwest to the Mercury Highway. The latter route was found to be clear of contamination.

Check stations were established immediately at the intersection of the Mercury Highway and the 3b access road, and at the BJY. Traffic entering and exiting the forward area was routed via the above mentioned clear route.

The initial gamma radiation survey was completed by eight monitors at a mid-time of 1344 hours. No significant alpha contamination was found outside the perimeter of the 1 r/hr isointensity line.

The initial survey of non-shot areas was performed by six monitors. Results of this survey were as follows:

Intensity mr/hr	Location	Time hours
1000	0.9 Miles South of BJY	1336
160	Area 3b GZ	1314
40	1-355	1513

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
Sept. 6	H / 5 hours	1925
Sept. 7	D / 1	0658
Sept. 8	D / 2	0821
Sept. 9	D / 3	0741

3.24.2 Plotting and Briefing Branch

Results of the surveys were plotted for display at various locations. (Figures No. 3.24.1 through 3.24.5).

Alpha contamination readings were indicated on all surveys plotted

Briefings were conducted and area access permits were certified for each party as follows:

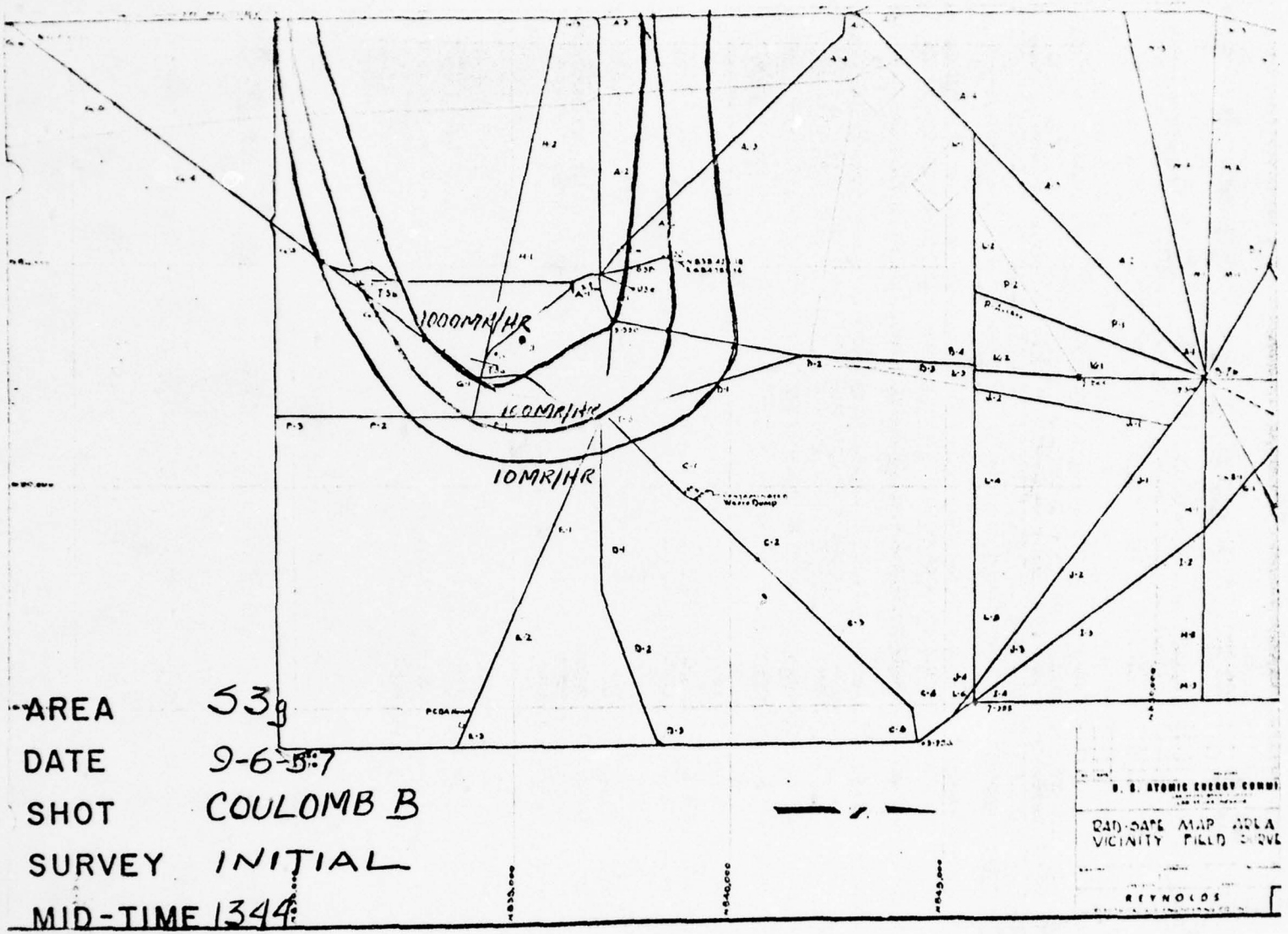

Figure 3.24.1 Coulomb B, Initial

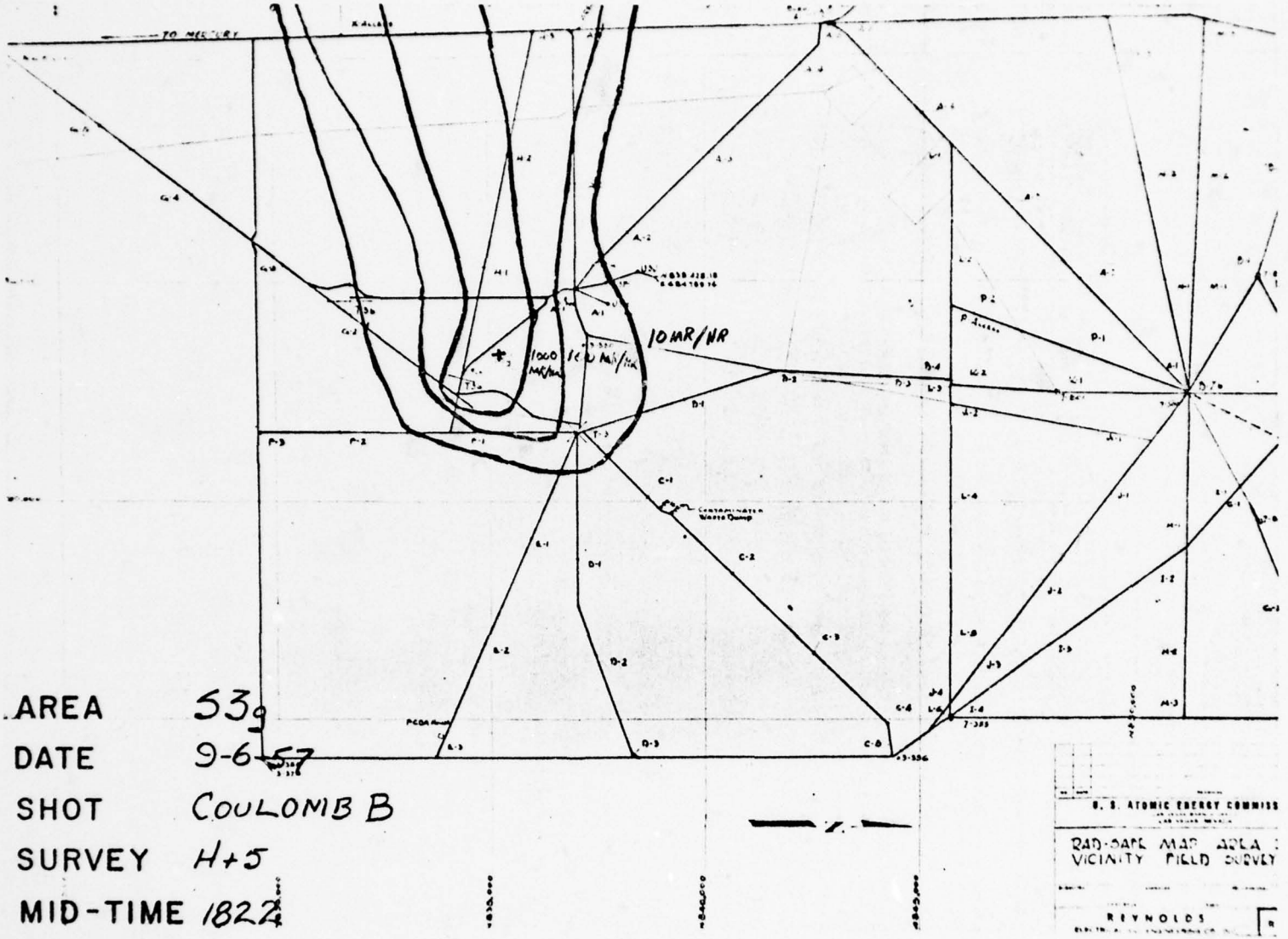

Figure 3.24.2 Coulomb B, H + 5

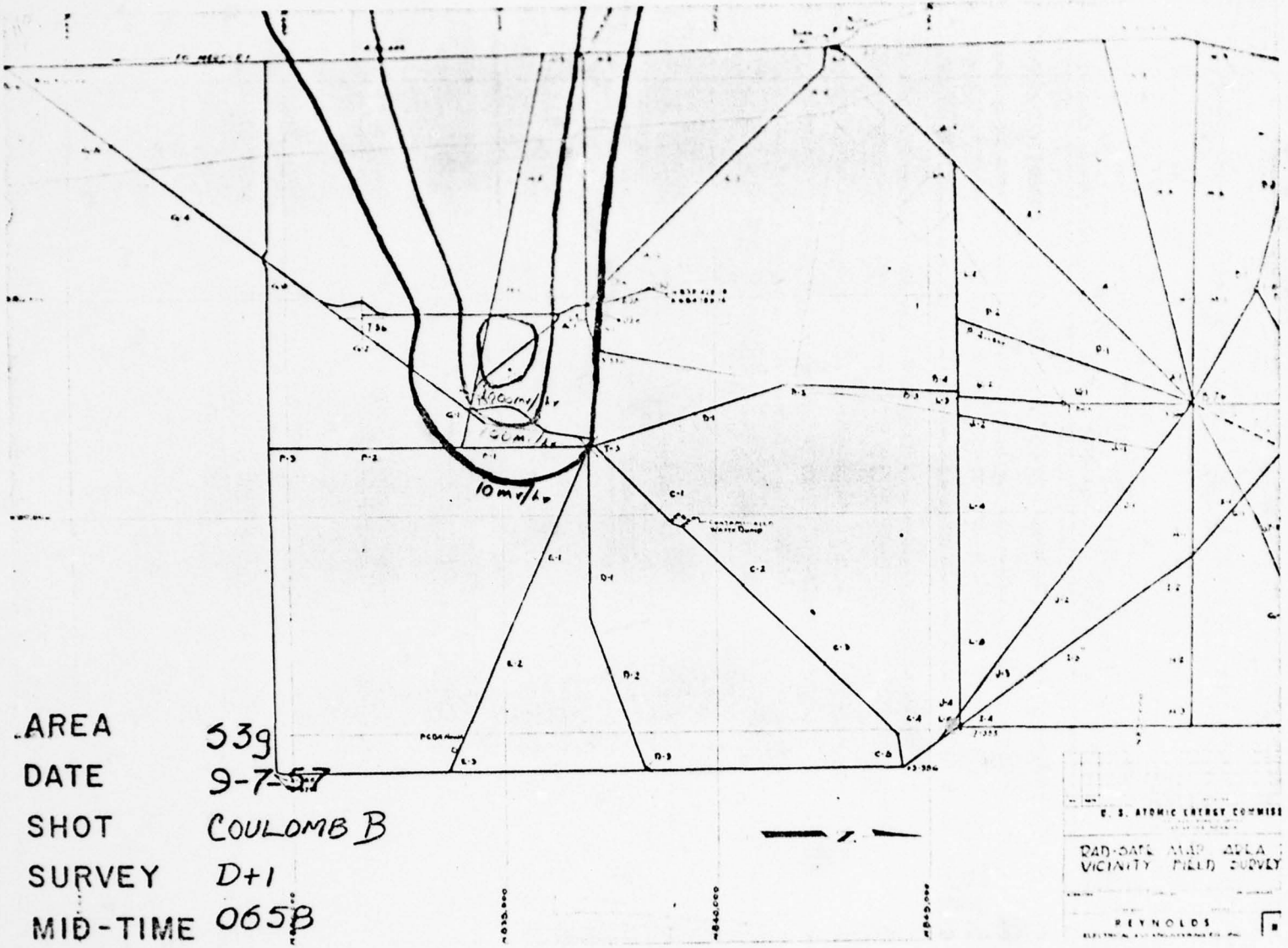

Figure 3.24.3 Coulomb B, D + 1

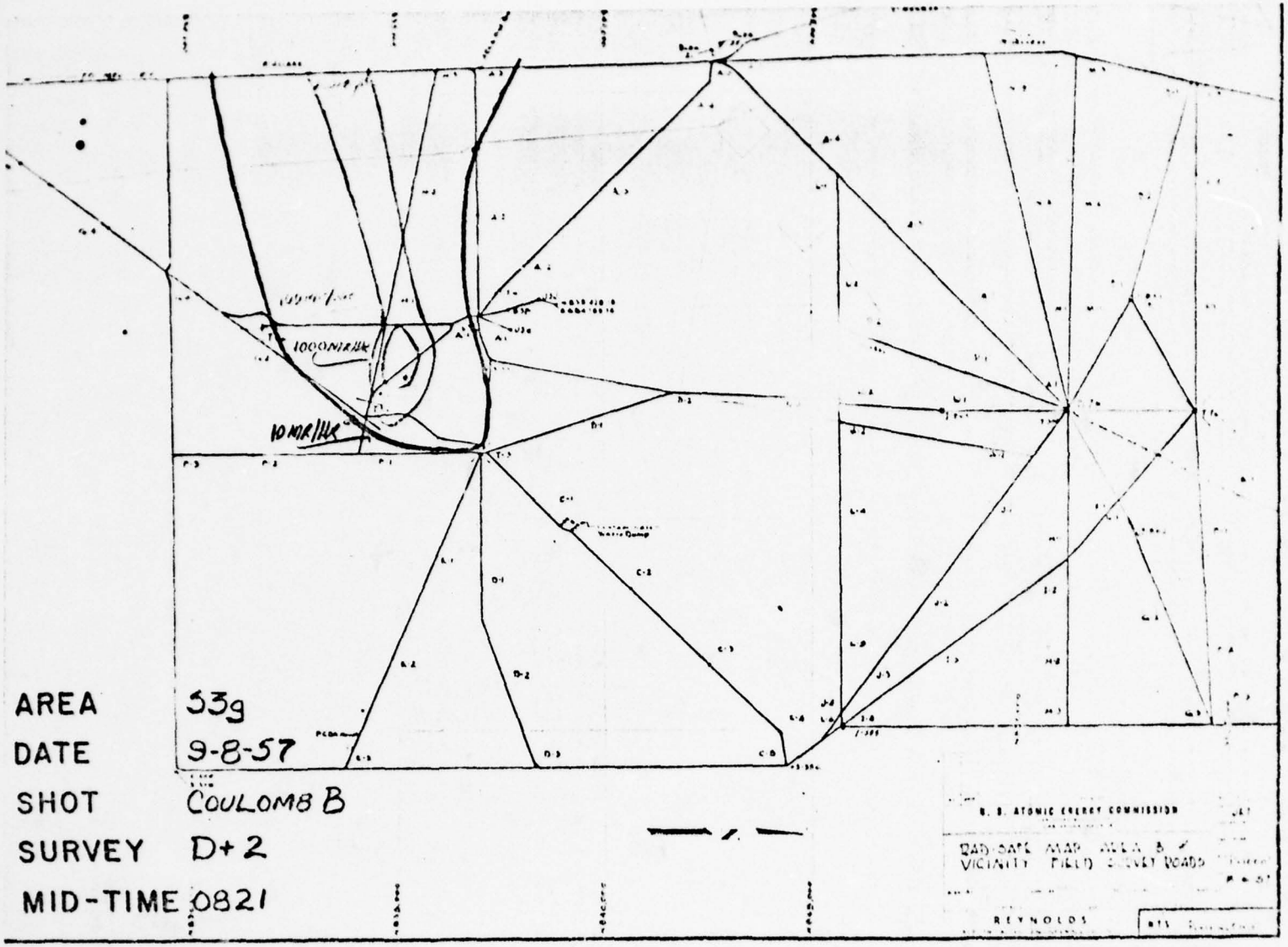

Figure 3.24.4 Coulomb B, D + 2

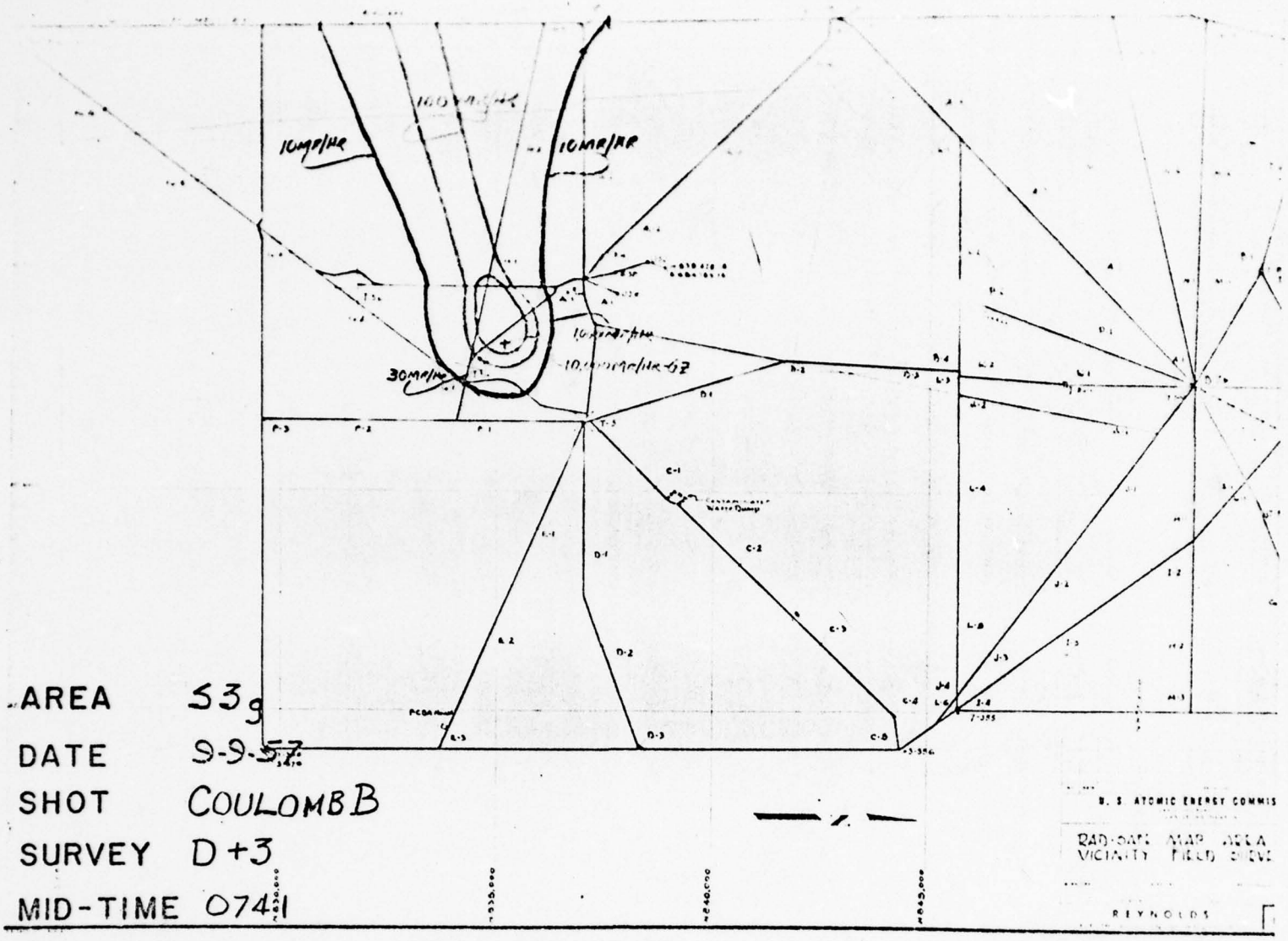

Figure 3.24.5 Coulomb B, D + 3

Date	Scheduled Parties	Projects Involved	Personnel Involved
Sept.	17	6	36
Totals	17	6	36

3.24.3 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
Sept. 6	10	10
Total	10	10

Dosimeters:

Date	Issued	Received
Sept. 6	20	20
Total	20	20

3.24.4 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 36 people as follows:

Item	Number
Coveralls	36
Shoe Covers (pairs)	36
Respirators	36

The laundry processed 438 pieces of anti-contamination items.

3.25 LaPlace (September 7 through September 12, 1957)

LaPlace was a device fired from a balloon suspended 750 feet above Area 7b. The device was detonated at 0600 hours on September 8, 1957. The fireball quickly turned into a misshapen mushroom cloud which separated from its stem and rose to 19,500 feet MSL. The cloud was elongated by low speed winds blowing in different directions at different levels. The top of the cloud was blown slightly west of south and the lower levels east of south.

3.25.1 General Monitoring Branch

The aerial survey team departed at 0733 hours. Results obtained from this survey were as follows:

Intensity r/hr	Location	Altitude feet	Time hours
22	7-300	50	0740
23	S3g	50	0745

The initial ground survey teams departed at 0605 hours. Results of the ground survey of non-shot areas were as follows:

Intensity mr/hr	Location	Time hours	Area
11	2-380	0624	2
10	3-300	0625	3
600	Intersection Area 2c Access Road & Area 10 Perimeter	0629	8
25	Gate 385	0633	Yucca Flat
600	Greenhouse Pad	0638	9
34	9-300	0641	9
Background	Area 3b GZ	0655	3
Background	Area 2 GZ	0715	2
15	1-380	0732	1
12	12-300	0643	12

A check station was established at the BJY to control access to the contaminated areas.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
Sept. 8	D / 1/4	1213
Sept. 9	D / 1	0620
Sept. 10	D / 2	0554
Sept. 11	D / 3	0620
Sept. 13	D / 5	0616

3.25.2 Plotting and Briefing Branch

Results of the surveys were plotted for display at various locations. (Figures No. 3.25.1 through 3.25.5).

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
Sept. 7	62	13	170
Sept. 8	12	10	56
Sept. 9	37	11	112

Date	Scheduled Parties	Projects Involved	Personnel Involved
Sept. 10	23	9	85
Sept. 11	32	9	119
Sept. 12	28	8	89
Totals	194	60	631

3.25.3 Decontamination Branch

The following items were decontaminated at the CP-6:

Equipment	Number
Vehicles	28
Television Cameras	2
Electrical Gauges	4

3.25.4 Special Assignments Branch

The following radioactive material was monitored and cleared for release from the Nevada Test Site:

Material	Number of Boxes	Agency
Soil Samples	3	LASL

No significant radiation levels were encountered on the highway between the CP-2 and Mercury after the detonation.

Air-borne Radioactivity (D-day Averages):

Air Samples:

Location	Long-Lived Alpha d/m per M^3
Warehouse 6	Background
CP-2	0.1
Gate 385	0.1
Area 13	0.1

Fallout Trays:

Location	Long-Lived Alpha d/m per ft^2
Warehouse 6	17
Well 5B	17
CP-2	Background
Gate 385	Background
Area 13	50
Shot Area (Average)	14

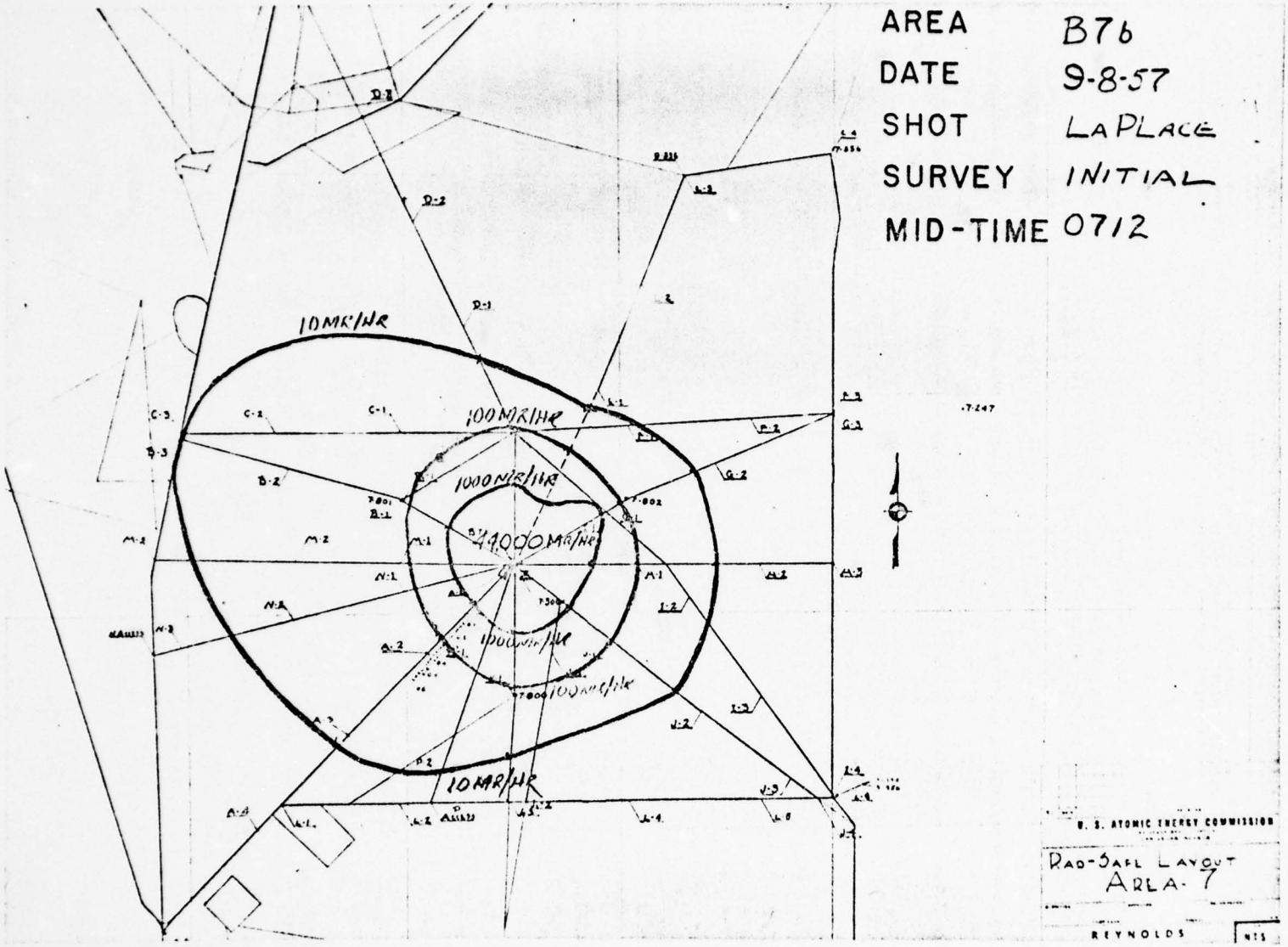

Figure 3.25.1 LaPlace, Initial

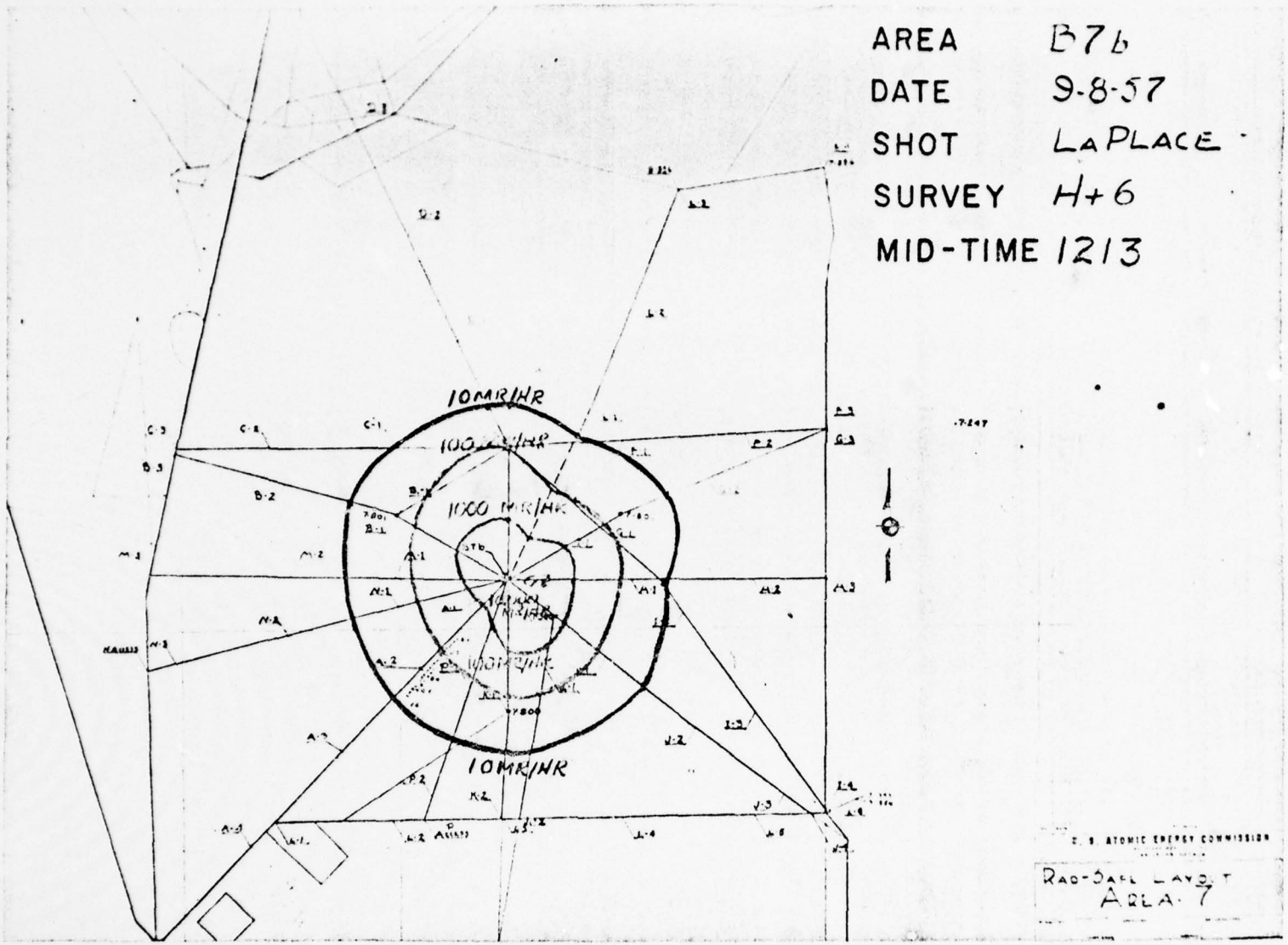

Figure 3.25.2 LaPlace, H + 6

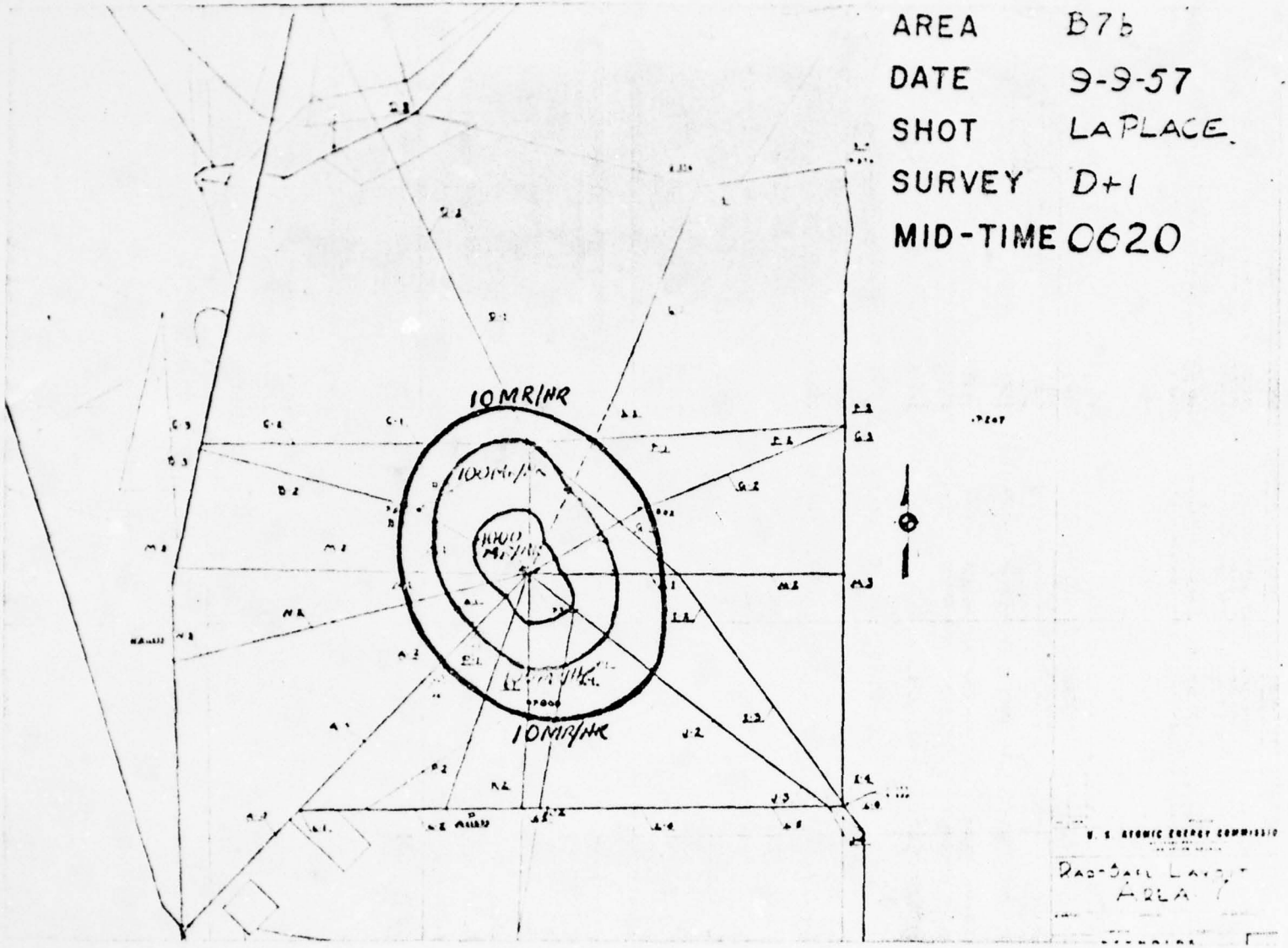

Figure 3.25.3 LaPlace, D + 1

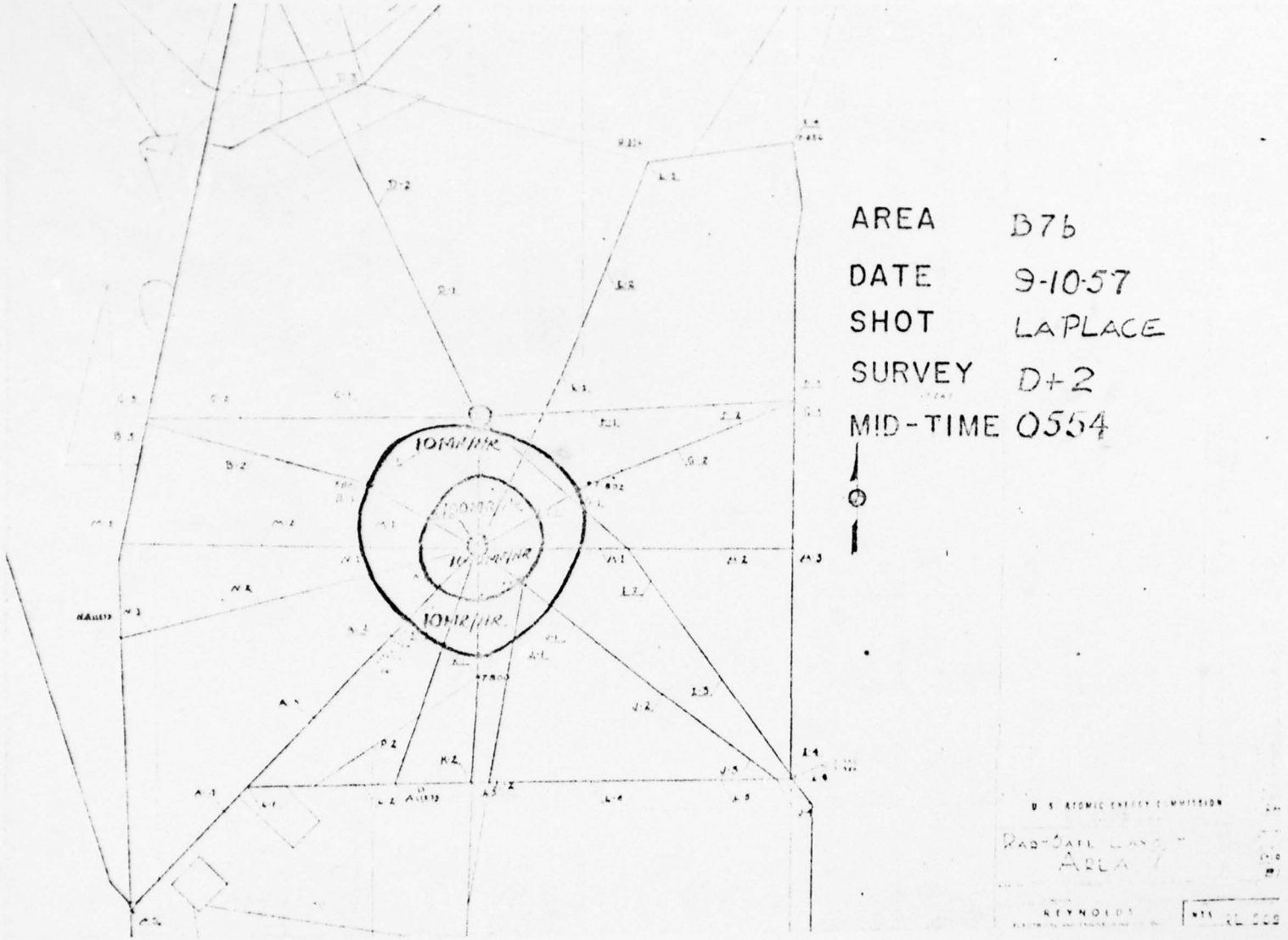

Figure 3.25.4 LaPlace, D + 2

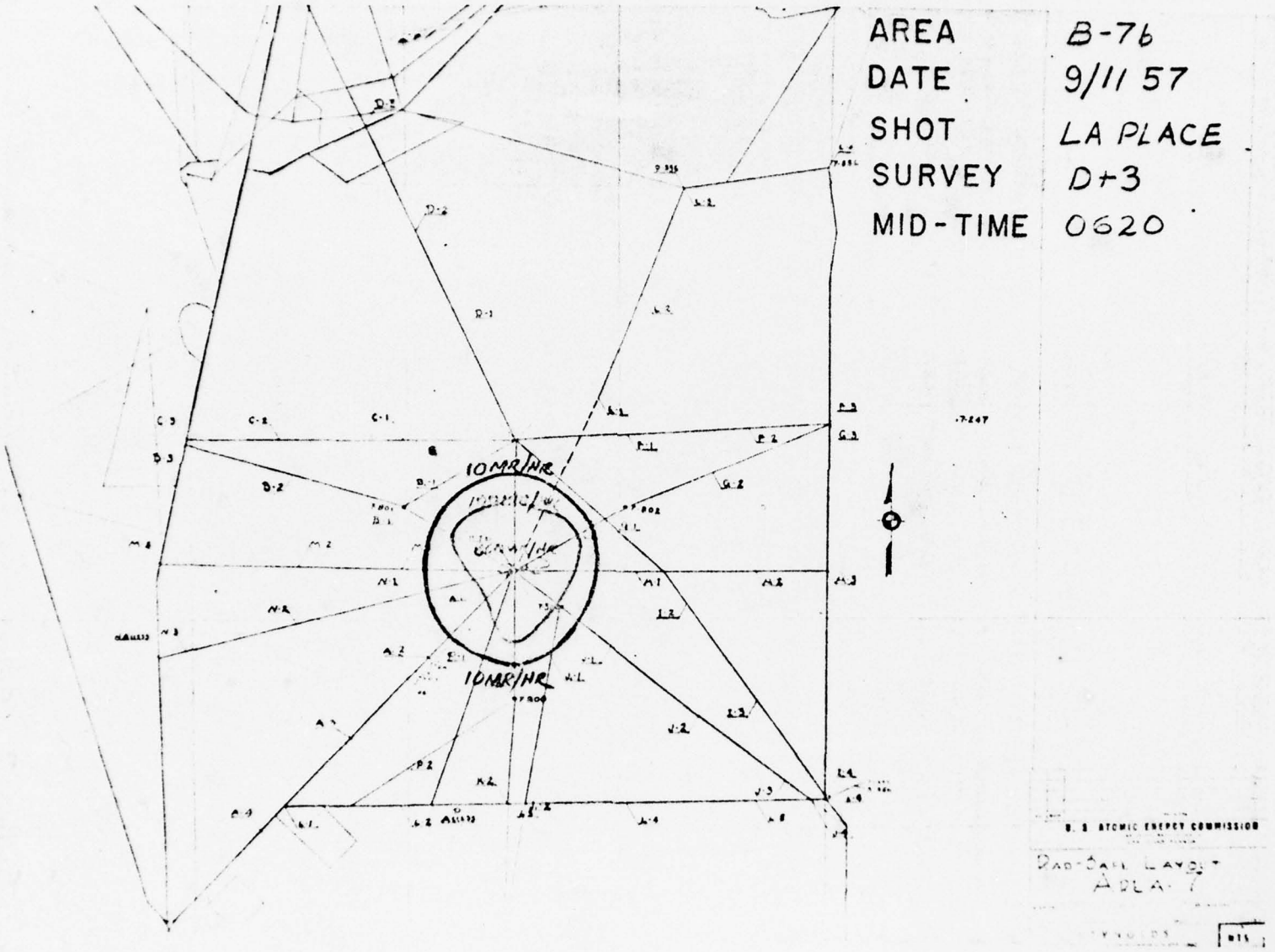

Figure 3.25.5 LaPlace, D + 3

Radiation surveys in "clean working and living areas" in Mercury and the CP Area were negative.

The following samples were analyzed in the laboratory:

Type	Number
Air Samples	75
Nasal Swabs	34
Fallout Trays	116
Surface Swipes	240
Water Samples	6
Total	471

3.25.5 Training Branch

A one-hour lecture was given to 30 FCDA personel on September 9.

3.25.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
Sept. 7	390	656
Sept. 8	242	355
Sept. 9	64	110
Sept. 10	196	373
Sept. 11	203	4333
Sept. 12	194	487
Totals	1289	6314

Dosimeters:

Date	Issued	Received
Sept. 7	110	110
Sept. 8	71	71
Sept. 9	64	64
Sept. 10	68	68
Sept. 11	46	46
Sept. 12	33	33
Totals	392	392

On September 11, approximately 4000 film badges were received from the Off-Site Rad-Safe Organization for processing and recording.

3.25.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 1153 people as follows:

Item	Number
Coveralls	380
Shoe Covers (pairs)	1056
Respirators	156
Other Items	1136

The laundry processed 3942 pieces of anti-contamination items

3.26 Fizeau (September 13 through September 14, 1957)

Fizeau was a device fired from a 500-foot tower in Area 3b. The device was detonated at 0945 hours on September 14, 1957. The cloud rose very rapidly until its top was above 45,000 feet MSL. It was sheared quickly by the winds into three major segments: the cloud top was blown at 13 knots west of due north; the middle section at 13 knots east of due north; and the lower section at a lesser speed in northwesterly direction from the detonation point.

3.26.1 General Monitoring Branch

The aerial survey team departed at 1050 hours. Results obtained from this survey were as follows:

Intensity r/hr	Location	Altitude feet	Time hours	Area
500	Area 3b GZ	150	1116	3
25	3-300	25	1110	3
12	BJY	25	1106	Yucca Flat
0.1	Burro Shelters	25	1120	3
0.5	Collimators	100	1118	3

Subsequent aerial re-surveys indicated the following readings:

Intensity r/hr	Location	Altitude feet	Time hours	Area	Re-survey days
1.8	BJY	50	1502	Yucca Flat	D / 1
0.3	2-380	50	1610	2	D / 1
0.025	2-300	500	1611	2	D / 1
0.1	Mesa	75	1615	12	D / 1
20.0	Area 3b GZ	500	0935	3	D / 2
10.0	Area 3b GZ	600	0940	3	D / 2
0.48	Area 3 GZ	25	0942	3	D / 2

The initial ground survey teams departed at 0950 hours. Results of the ground survey of non-shot areas were as follows:

Intensity mr/hr	Location	Time hours	Area
300	12-300	1052	8
6000	2-380	1102	2
20	7-356	1112	7
1000	7-300	1150	7
200	B-9	1236	9
350	9-300	1251	9

A check station was established at the intersection of the Mercury Highway and the 3b access road to control access into the contaminated areas.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
Sept. 14	D / 1/4	1557
Sept. 15	D / 1	0625
Sept. 16	D / 2	0947
Sept. 17	D / 3	0633
Sept. 19	D / 5	0655

There were six monitors provided for projects and REECO support.

3.26.2 Plotting and Briefing Branch

Results of the surveys were plotted for display at various locations. (Figures No. 3.26.1 through 3.26.4).

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
Sept. 13	12	5	33
Sept. 14	17	12	107
Totals	29	17	140

3.26.3 Decontamination Branch

The following items were decontaminated at the CP-6:

Equipment	Number
Vehicles	82
Bulldozer	1

3.26.4 Special Assignments Branch

No significant radiation levels were encountered on the highway between the CP-2 and Mercury after the detonation.

Air-borne Radioactivity:

Air Samples: (D-day Averages)

Location	Long-Lived Alpha d/m per M^3
Warehouse 6	Background
CP-2	Background
Gate 385	Background
Area 13	Background

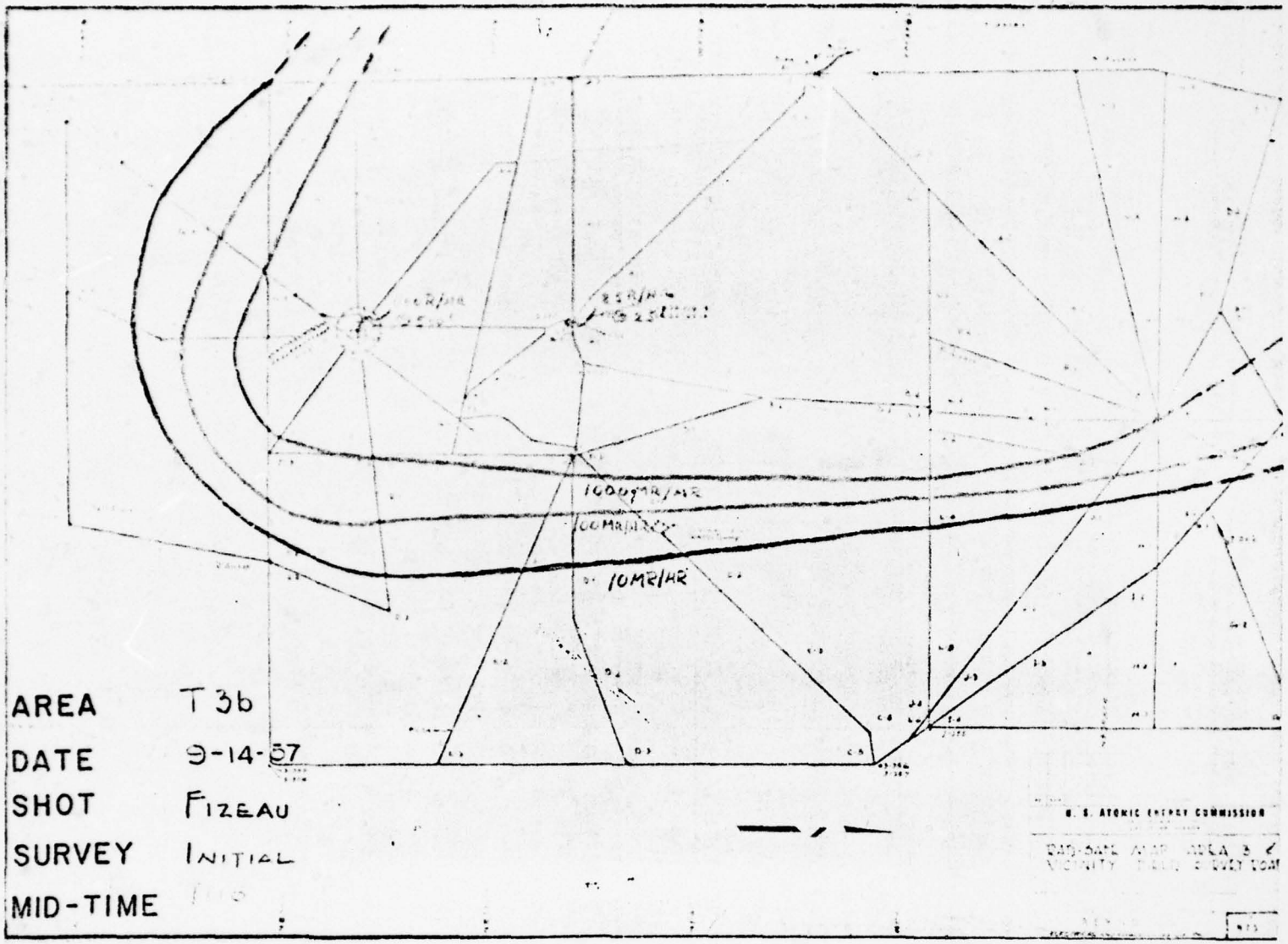

Figure 3.26.1 Fizeau, Initial

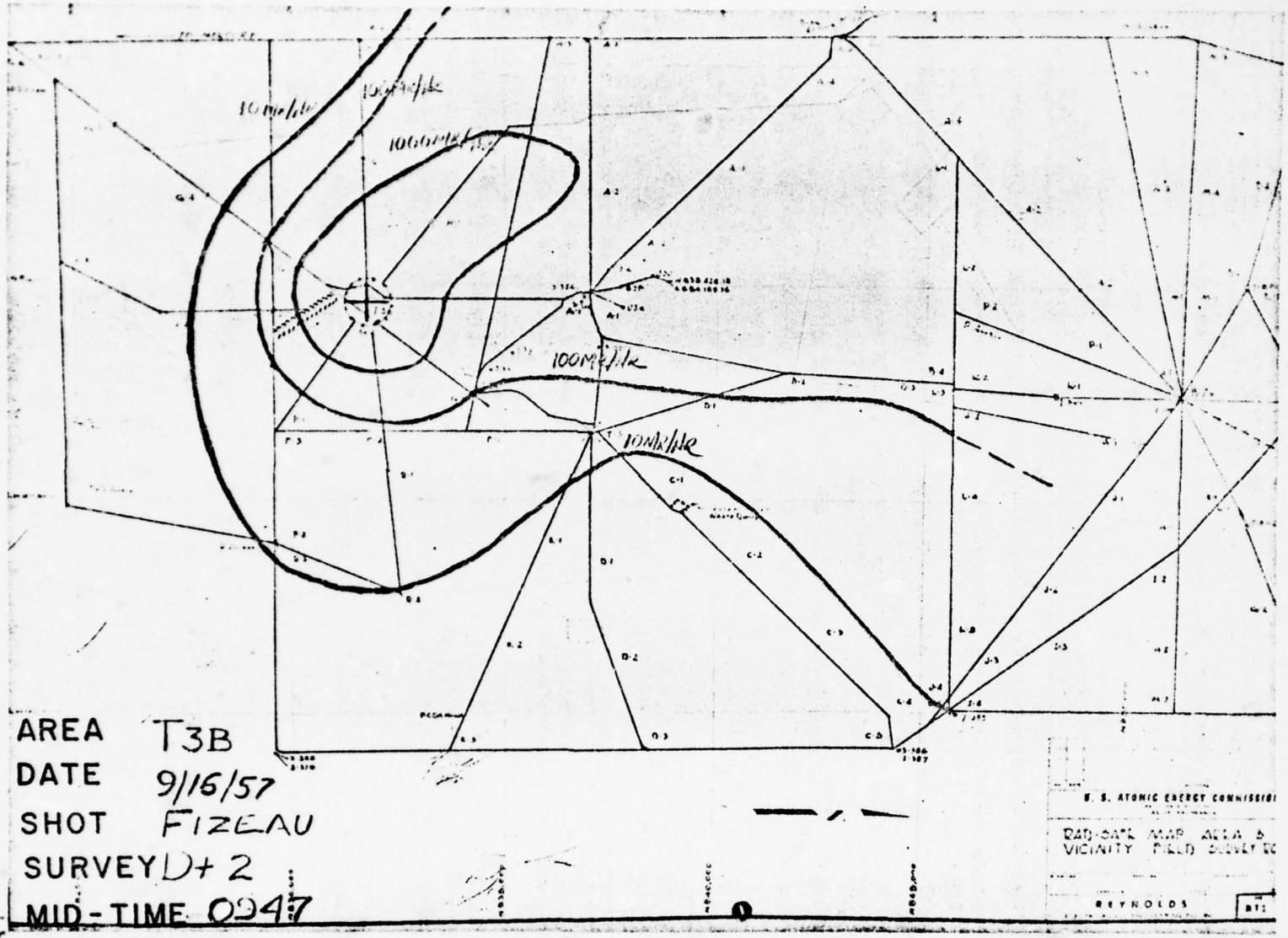

Figure 3.26.4 Fizeau, D + 2

See back of this page for Figs 3.26.2 3.26.3

Fallout Trays: (D-4 to D / 7 Averages)

Location	Long-Lived Alpha d/m per ft^2
Well 5	1.5×10^2
CP-2	1.1×10^3
Gate 385	6.5×10^2
CP-2	3.5×10^2
Area 13	3.3×10^3
Shot Area (Average)	1.0×10^4

No increase in radioactivity was noted in well and drinking water samples.

Radiation surveys in "clean working and living areas" in Mercury and the CP Area were negative.

Exposures indicated by film badges for the period D-1 to H / 52 hours in working areas were as follows:

Location	Exposure mr
Gate 385	320
Area 13	150

The following samples were analyzed in the laboratory:

Type	Number
Air Samples	27
Nasal Swabs	6
Water Samples	6
Total	40

3.26.5 Training Branch

A Rad-Safe indoctrination lecture was given to 86 people in the observer area prior to the Fizeau detonation on September 14.

3.26.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
Sept. 13	246	1770
Sept. 14	130	242
Totals	376	2012

Dosimeters:

Date	Issued	Received
Sept. 13	45	45
Sept. 14	125	110
Totals	170	155

3.26.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 251 people as follows:

Item	Number
Coveralls	221
Shoe Covers (pairs)	223
Respirators	120
Other Items	504

The laundry processed 558 pieces of anti-contamination items.

3.27 Newton (September 16 through September 21, 1957)

Newton was a device fired from a 1500-foot balloon anchored in Area 7b. The device was detonated at 0550 hours on September 16, 1957. The main cloud rose until it extended 19,000 feet to above 33,000 feet MSL and was blown generally in a northeasterly direction at about 60 miles per hour.

3.27.1 General Monitoring Branch

The aerial survey team departed at 0845 hours. Results obtained from this survey were as follows:

Intensity r/hr	Location	Altitude feet	Time hours	Area
20	Area 3b GZ	200	0852	3
0.3	3-300	25	0853	3
20	500' East of 3b	25	0855	3
10	Area 7b GZ	500	0900	7

A subsequent aerial re-survey on D / 1 day indicated the following readings:

Intensity r/hr	Location	Altitude feet	Time hours	Area
50	Area 3b GZ	25	0843	3
4	500' East of 3b	25	0845	3
9	Area 7b GZ	25	0847	7

The initial ground survey teams departed at 0555 hours. Results of the ground survey of non-shot areas were as follows:

Intensity mr/hr	Location	Time hours	Area
600	BJY	0625	Yucca Flat
40	Area 2 GZ	0636	2
18	Ground Zero	0707	9
10	Greenhouse (Inside)	0718	0
2	Gate 385	0720	Yucca Flat
76	Butler Building (Old)	0658	2
30	CETG Shelter	0659	2
20	Sub-Station 52	0650	Yucca Flat

A check station to control access into the contaminated area was established at intersection of the Mercury Highway and the 3b access road.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
Sept. 16	D / 1/4	1152
Sept. 17	D / 1	0601
Sept. 18	D / 2	0547
Sept. 19	D / 3	0637
Sept. 20	D / 4	0732
Sept. 21	D / 5	0624
Sept. 22	D / 6	0605

3.27.2 Plotting and Briefing Branch

Results of the surveys were plotted for display at various locations. (Figures No. 3.27.1 through 3.27.5).

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
Sept. 15	50	13	135
Sept. 16	29	12	128
Sept. 17	20	10	63
Sept. 18	33	10	73
Sept. 20	7	6	15
Sept. 21	6	6	14
Totals	145	57	428

3.27.3 Decontamination Branch

The following items were decontaminated at the CP-6:

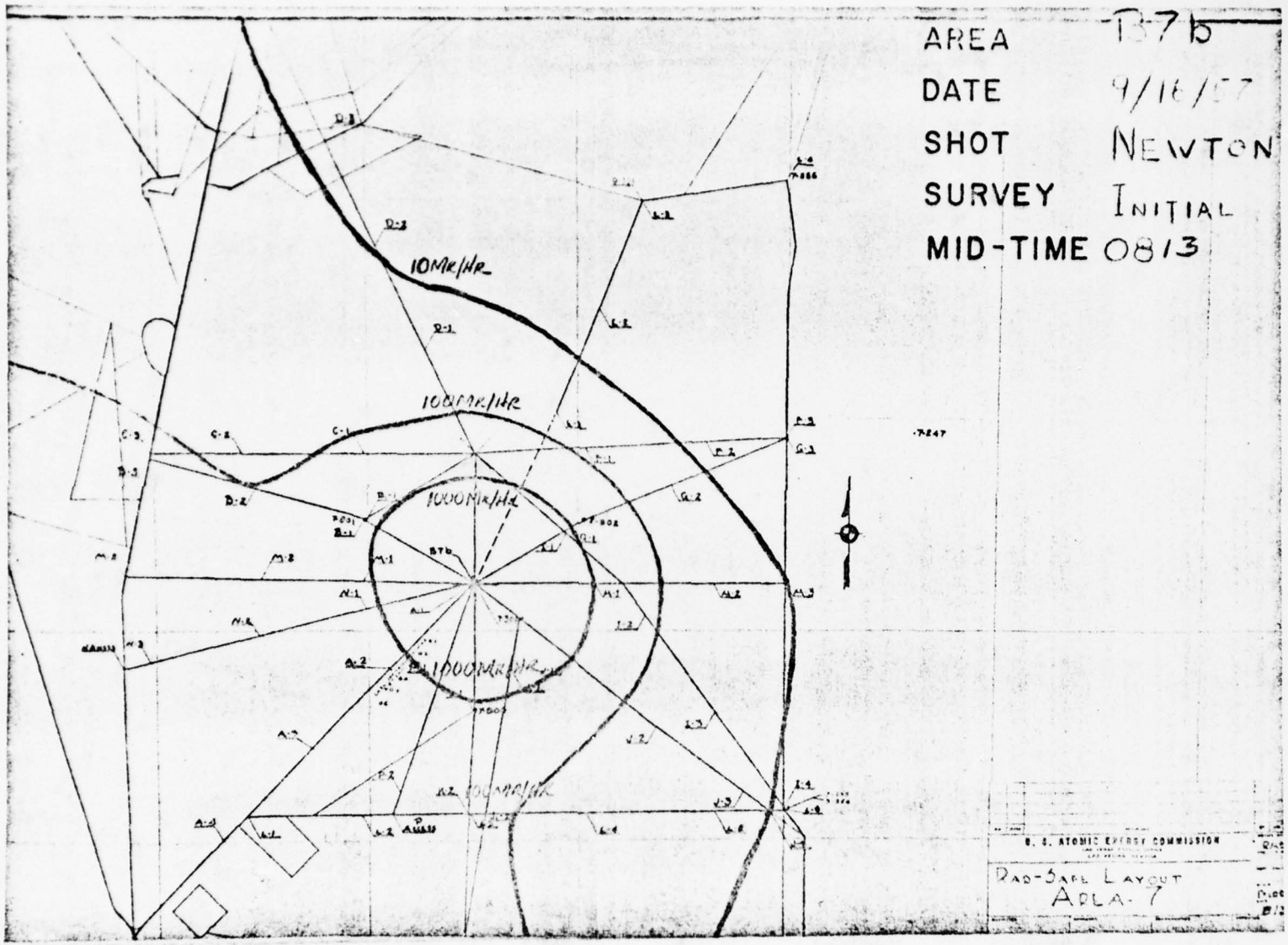

Figure 3.27.1 Newton, Initial

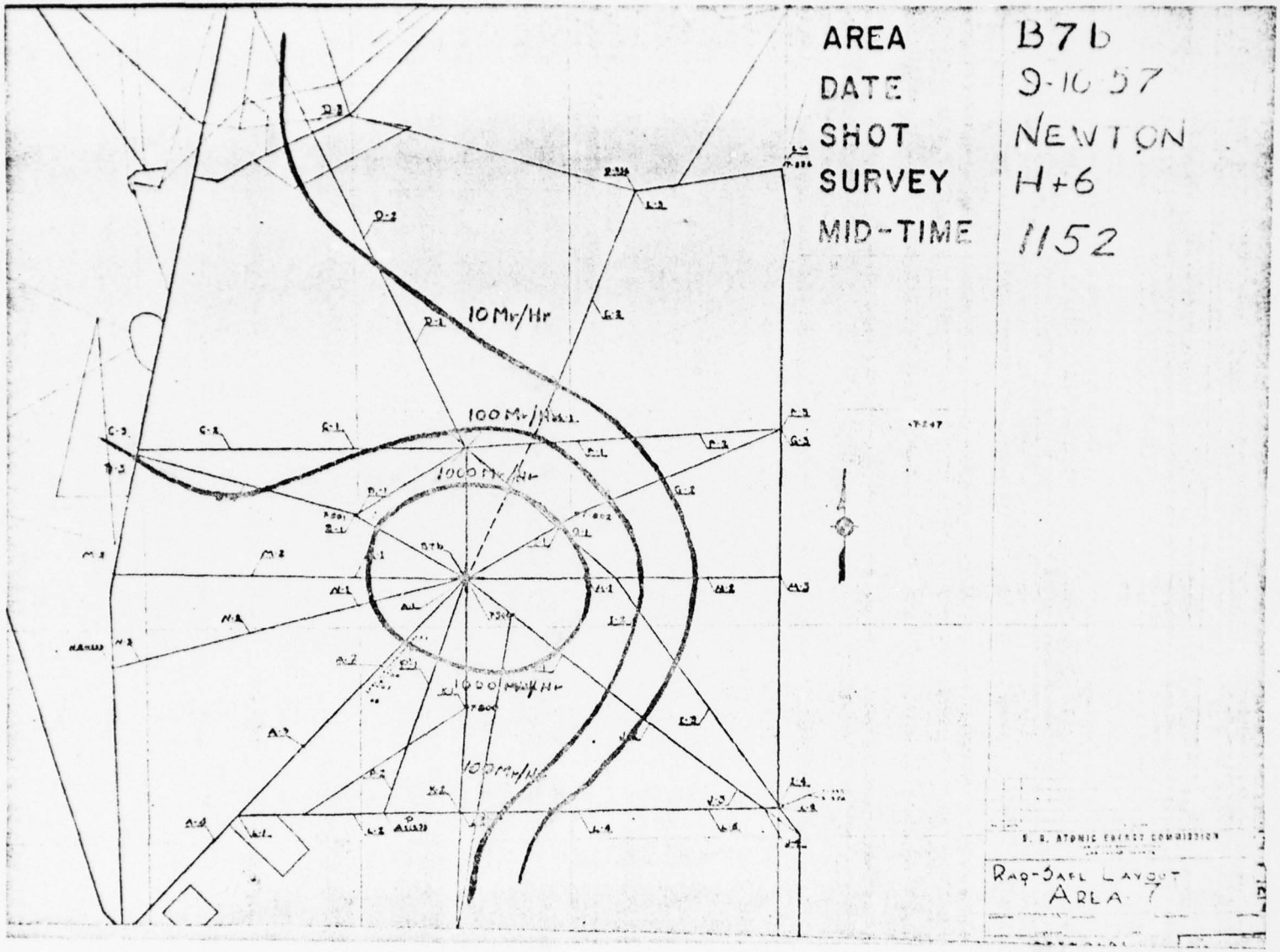

Figure 3.27.2 Newton, H + 6

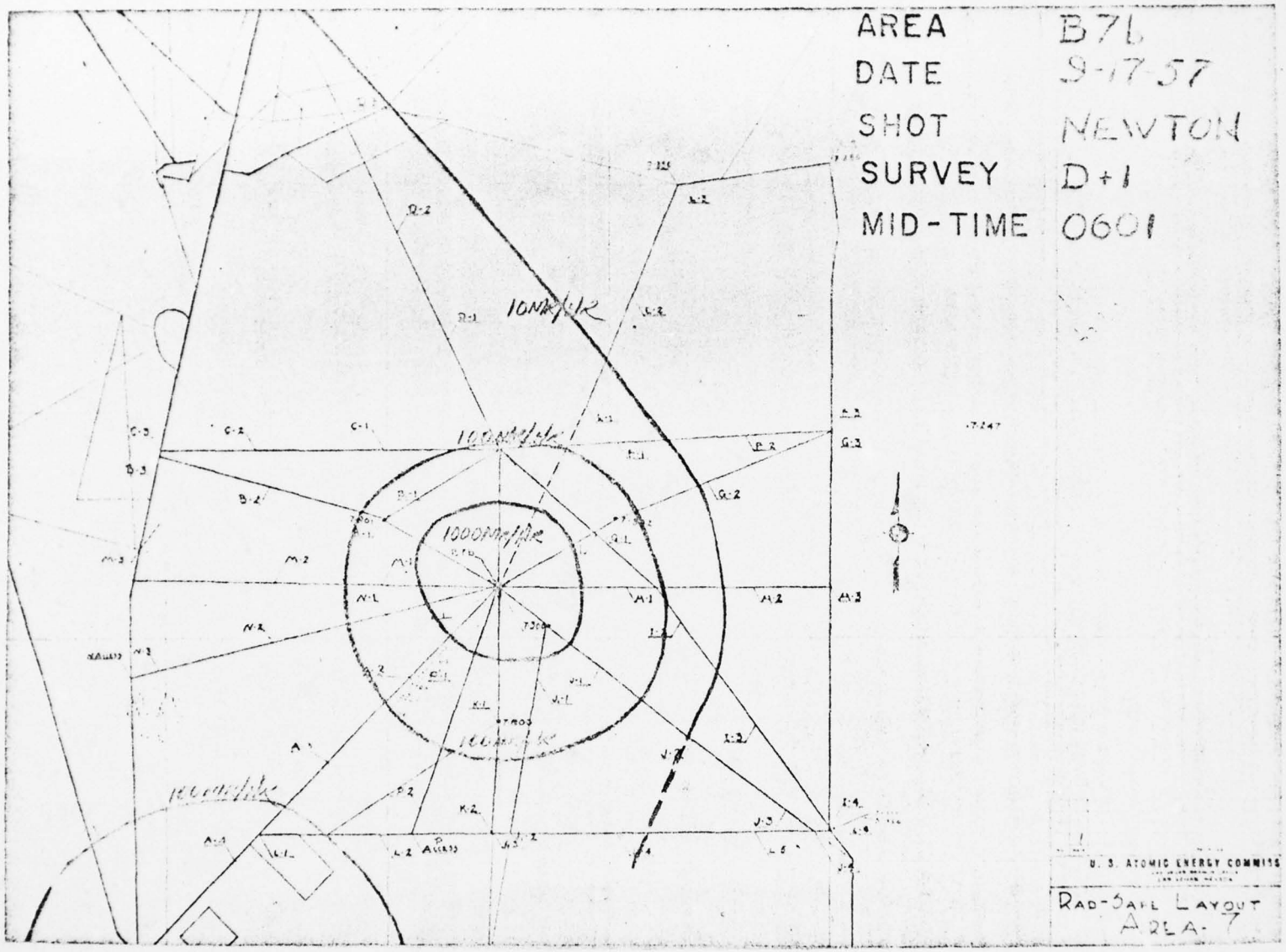

Figure 3.27.3 Newton, D +

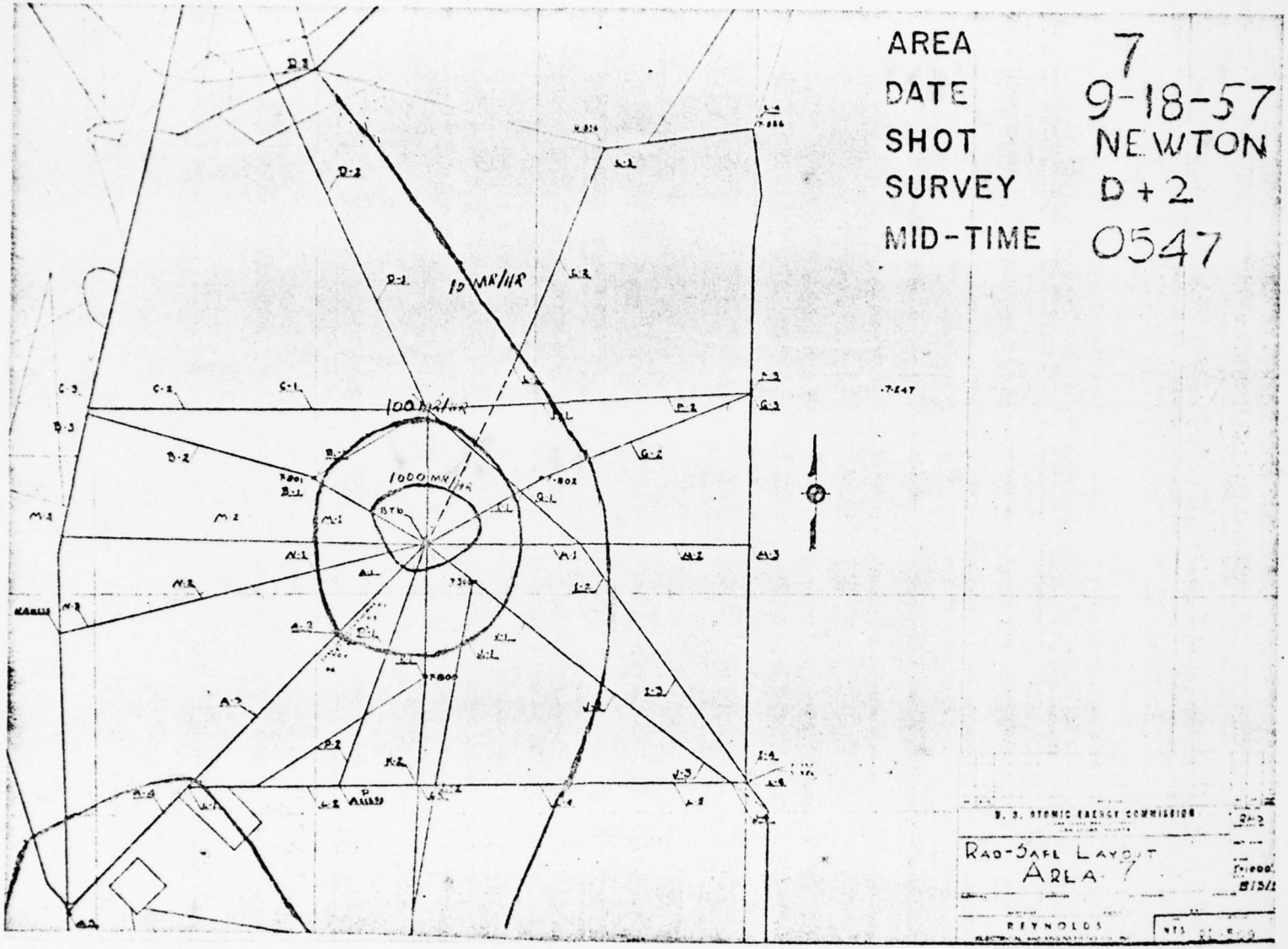

Figure 3.27.4 Newton, D + 2

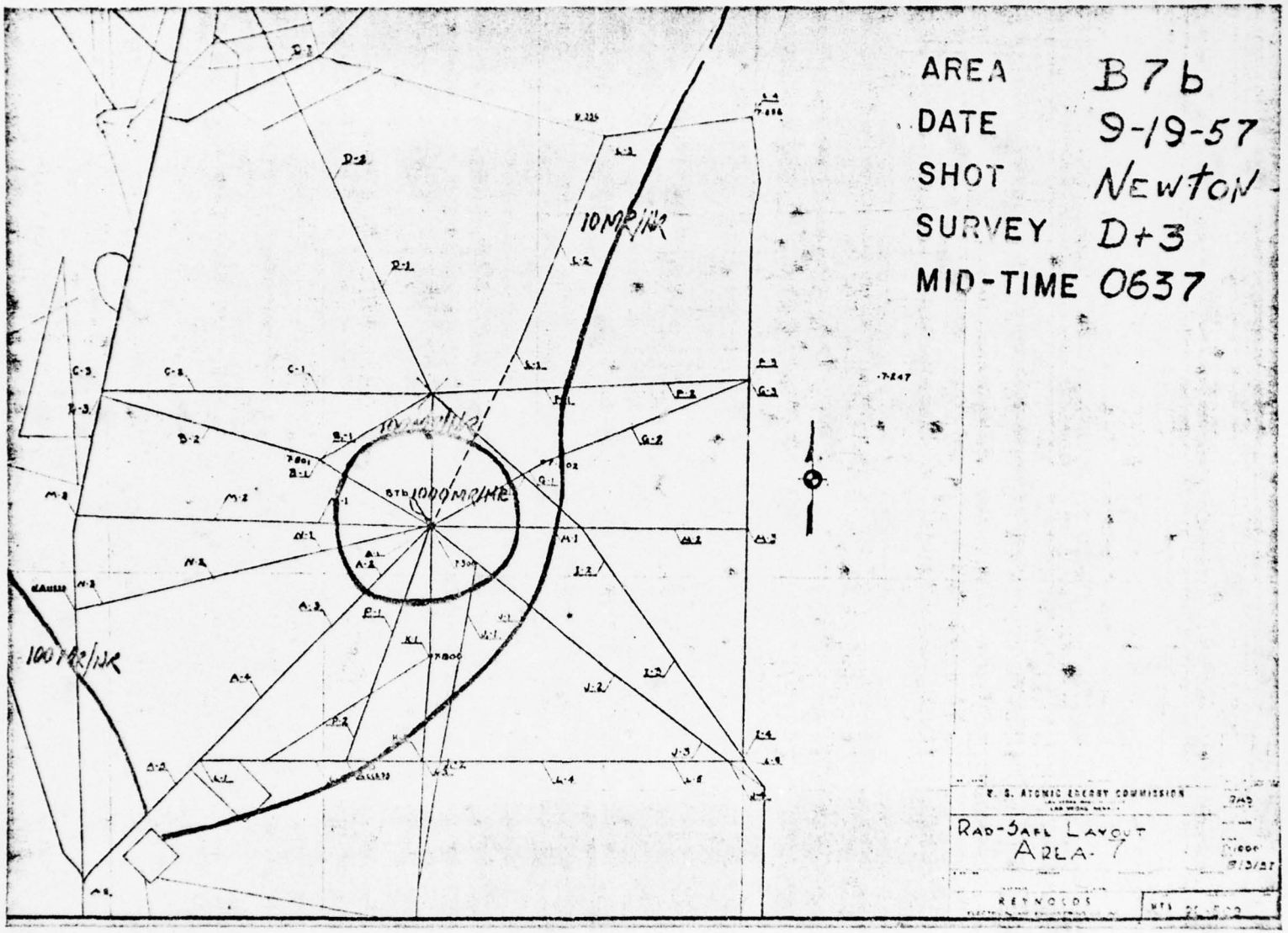

Figure 3.27.5 Newton, D + 3

Equipment	Number
Vehicles	55
Trailer	1

3.27.4 Special Assignments Branch

The following radioactive material was monitored and cleared for release from the Nevada Test Site:

Material	No. of Boxes	Agency
Contaminated Sticky Paper	1	Project 32.1
Contaminated Plywood	1	Project 32.1

No significant radiation levels were encountered on the highway between the CP-2 and Mercury after the detonation.

Air-borne Radioactivity:

Air Samples: (D-day Averages)

Location	Long-Lived Alpha d/m per M^3
Warehouse 6	Background
CP-2	1.1×10^2
Gate 385	3.6
Area 13	0.2

Fallout Trays: (D-7 to D / 1 Averages)

Location	Long-Lived Alpha d/m per ft^2
Well 5B	1.1×10^3
CP-2	3.5×10^3
Gate 385	6.5×10^2
Area 13	3.3×10^3
Gate 120	1.5×10^2
Shot Area (Average)	1.5×10^2

No increase in radioactivity was noted in well and drinking water samples.

Radiation surveys in "clean working and living areas" in Mercury and the CP Area were negative.

The following samples were analyzed in the laboratory:

Type	Number
Air Samples	123
Nasal Swabs	51

Type	Number
Surface Swipes	10
Fallout Trays	106
Water Samples	7
Total	297

3.27.5 Training Branch

Routine duties were performed by the Training Branch.

3.27.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
Sept. 15	108	209
Sept. 16	125	319
Sept. 17	167	328
Sept. 18	107	154
Sept. 19	211	411
Sept. 20	151	240
Sept. 21	180	330
Totals	1049	1991

Dosimeters:

Date	Issued	Received
Sept. 15	95	90
Sept. 16	56	56
Sept. 17	52	55
Sept. 18	60	60
Sept. 19	12	12
Sept. 20	10	10
Sept. 21	14	14
Totals	299	297

3.27.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 1158 people as follows:

Item	Number
Coveralls	436
Shoe Covers (pairs)	1126
Respirators	215
Other Items	1500

The laundry processed 3319 pieces of anti-contamination items.

3.28 Rainier (September 19, 1957)

Rainier was a device fired in a deep underground tunnel in Area 12. The device was detonated at 1000 hours on September 19, 1957. There was no flash of light, no wave of heat, no shock wave, and no mushroom cloud after the detonation.

Spurts of dust rising from the 7,500-foot mesa top and from the slope of the mesa indicated that there had been some heaving and settling of the mesa crown. There did not appear to be any spurt of dust or other debris issuing from the mouth of the tunnel. The blast from the detonation collapsed the tunnel wall and contained all the radiation.

3.28.1 General Monitoring Branch

The initial ground survey team of 10 men surveyed the shot area. They departed from a forward Control Point at 1015 hours.

The initial survey indicated that there was no increase in beta-gamma radiation above the maximum from previous fallout contamination. Negative results were obtained from an alpha survey.

A check station to control access into Area 12 was established six miles north of the Area 2 access road on the Area 12 road.

A re-survey of the shot area was made at H / 1-1/2 hours and no increase was found in beta-gamma radiation above the maximum from previous fallout contamination. There was no alpha contamination detected in the re-survey.

3.28.2 Plotting and Briefing Branch

The Plotting and Briefing Branch operated at the trailer check station in Area 12 on September 19.

A skeleton crew of three men was stationed at the CP-2 to continue operation of the Rad-Safe communications net, briefing of parties desiring to enter contaminated areas, and certifying of area access permits.

Data from the initial survey were not plotted because only negative results were obtained. The Plotting and Briefing Branch closed its Area 12 position at 1330 hours.

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
Sept. 19	24	9	55

3.28.3 Training Branch

Routine duties were performed by the Training Branch.

3.28.4 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
Sept. 19	24	24
Totals	24	24

Dosimeters:

Date	Issued	Received
Sept. 19	12	12
Totals	12	12

3.28.5 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 104 people as follows:

Item	Number
Coveralls	50
Shoe Covers (pairs)	97
Respirators	43
Other Items	70

The laundry processed 440 pieces of anti-contamination items.

The Rad-Safe emergency vehicle was equipped with supplies and moved to the forward observer point to be on hand in case of emergency.

3.29 Whitney (September 22 through September 26)

Whitney was a device fired from a 500-foot tower in Area 2. The device was detonated at 0530 hours on September 23, 1957. The cloud rose above 30,000 feet MSL with the mushroom top appearing to separate cleanly from the stem. Winds at all altitudes were close to a calm. Much of the cloud formed by the stem moved generally west, but one finger was blown in an easterly direction.

3.29.1 General Monitoring Branch

The aerial survey team departed at 0748 hours. Results obtained from this survey were follows:

Intensity r/hr	Location	Altitude feet	Time hours	Area
100	100' East of 2	500	0802	2
15	1000' South of 2-380	25	0807	2
5	2-380	200	0807	2

A subsequent aerial re-survey on D-day indicated the following readings:

Intensity r/hr	Location	Altitude feet	Time hours	Area
18.0	Area 3b GZ	25	1148	3
1.0	2-380	Ground	1156	2
2.5	South End of Mesa	100	1204	12
0.1	12-300	150	1200	12
0.4	Ground Zero	50	1205	12
1.0	Trailer Sites	25	1208	12

The initial ground survey teams departed at 0540 hours. Results of the ground survey of non-shot areas were as follows:

Intensity mr/hr	Location	Time hours	Area
20	7-357	0615	7
1	1-300	0624	1
30	7-300	0640	7
10	4-300	0641	4
6	9-300	0650	9
24	Greenhouse	0651	9
34	Area 9B	0654	9
37	2-247	0715	2
15	Butler Building (New)	0720	2

A check station was established at the intersection of the Mercury Highway and the 3b access road.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
Sept. 23	D / 1/4	1152
Sept. 24	D / 1	0635
Sept. 25	D / 2	0633
Sept. 26	D / 3	0624

3.29.2 Plotting and Briefing Branch

Results of the surveys were plotted for display at various locations. (Figures No. 3.27.1 through 3.27.5).

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
Sept. 22	3	2	12
Sept. 23	19	9	69
Sept. 24	15	8	50

Date	Scheduled Parties	Projects Involved	Personnel Involved
Sept. 25	12	9	34
Sept. 26	10	6	35
Totals	59	34	200

3.29.3 Decontamination Branch

The following items were decontaminated at the CP-6:

Equipment	Number
Vehicles	28
Compressors	2

3.29.4 Special Assignments Branch

The following radioactive material was monitored and cleared for release from the Nevada Test Site:

Material	No. of Boxes	Agency
Rocket Filters	1	UCRL*
2 mc Co^{60} Source	1	LASL
13 curie Co^{60} Source	1	LASL
Core Samples	51	USGS**

* University of California Radiation Laboratory
** United States Geological Survey

Two-hundred rental vehicles were monitored for equipment release to off-site vendors.

No significant radiation levels were encountered on the highway between the CP-2 and Mercury after the detonation.

Air-borne Radioactivity (D-day Averages):

Air Samples:

Location	Long-Lived Alpha d/m per M^3
Warehouse 6	Background
CP-2	0.1
Gate 385	0.1
Area 13	0.1

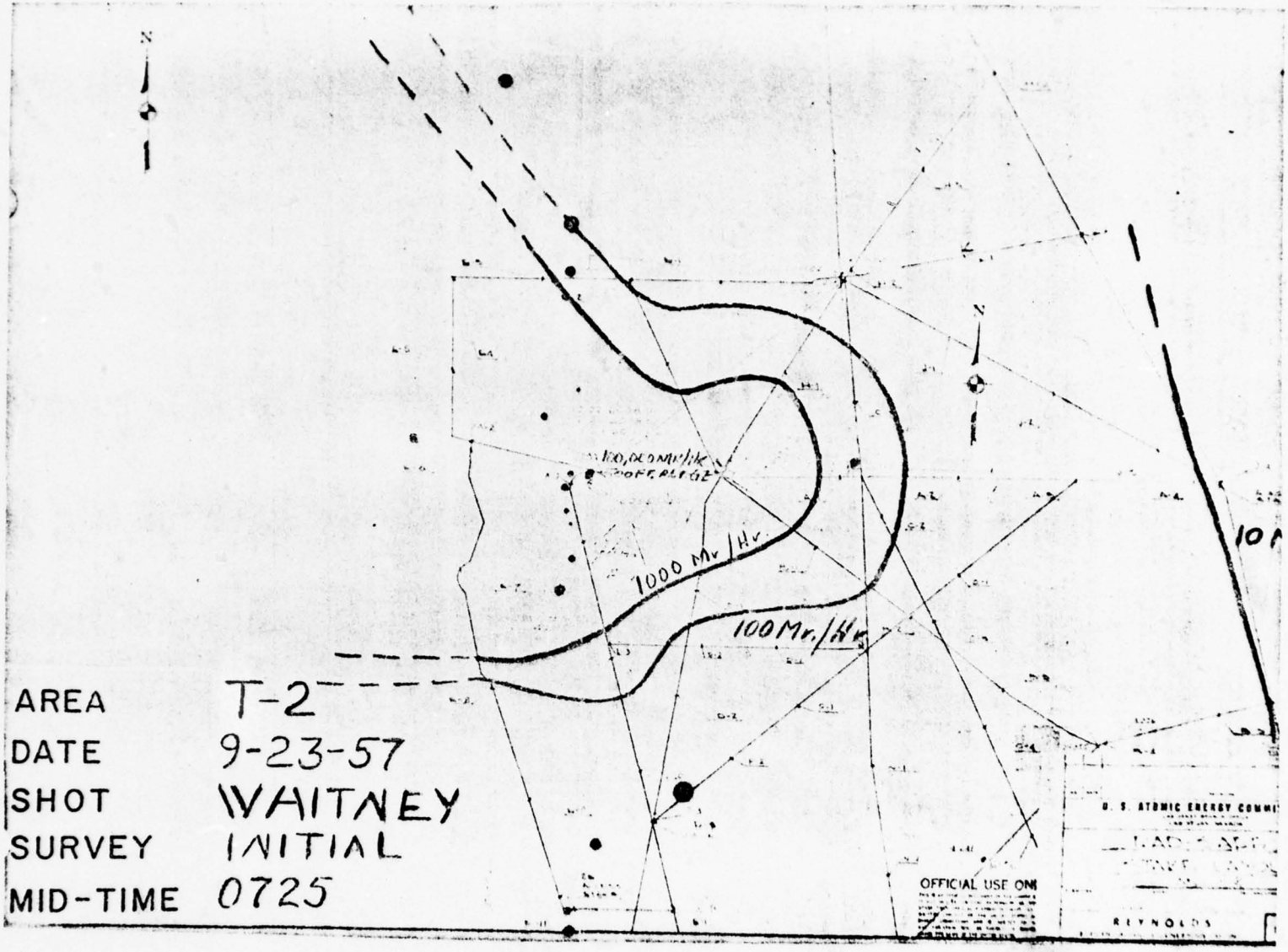

Figure 3.29./ Whitney, Initial

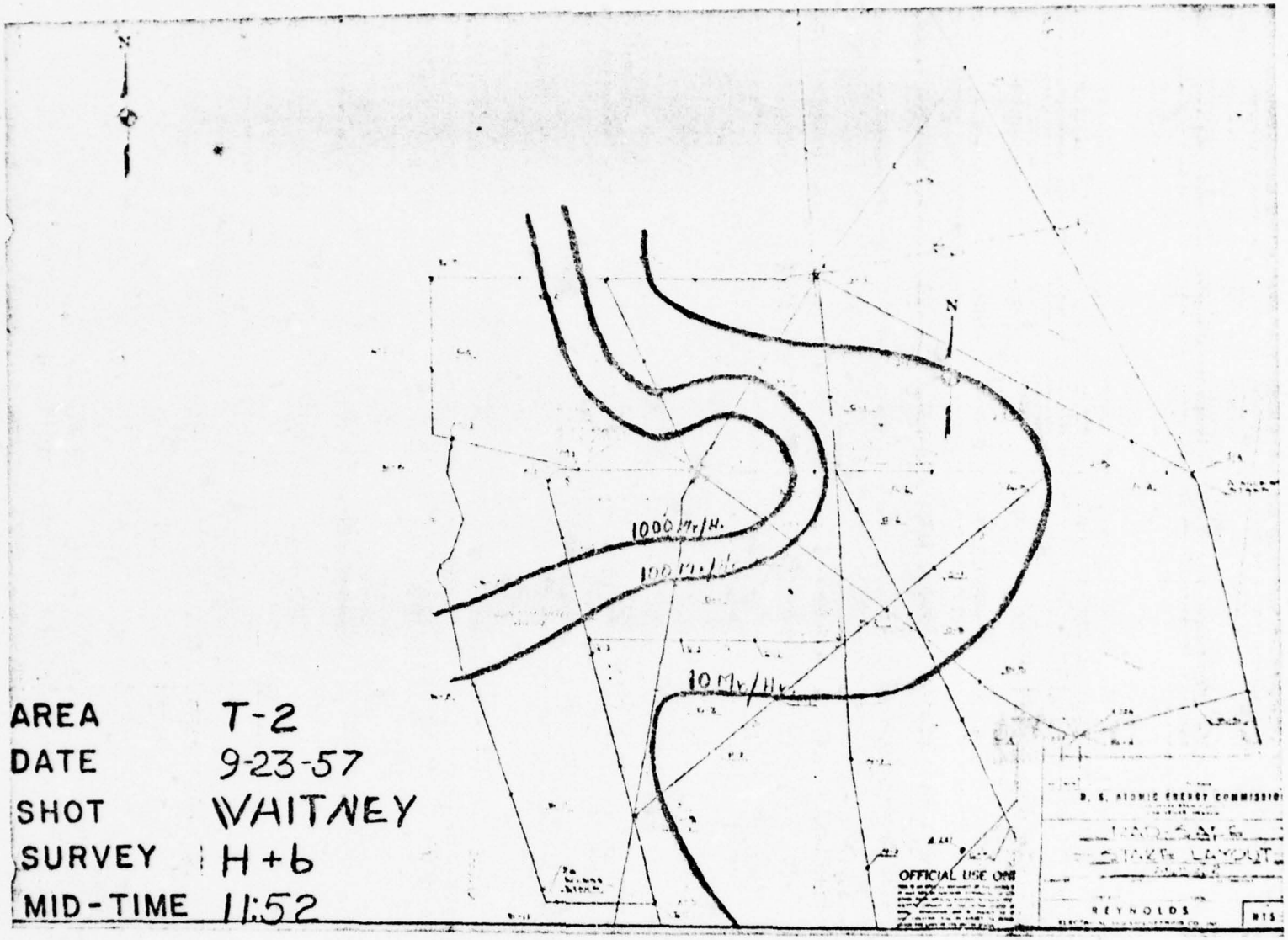

Figure 3.29.2 Whitney, H + 6

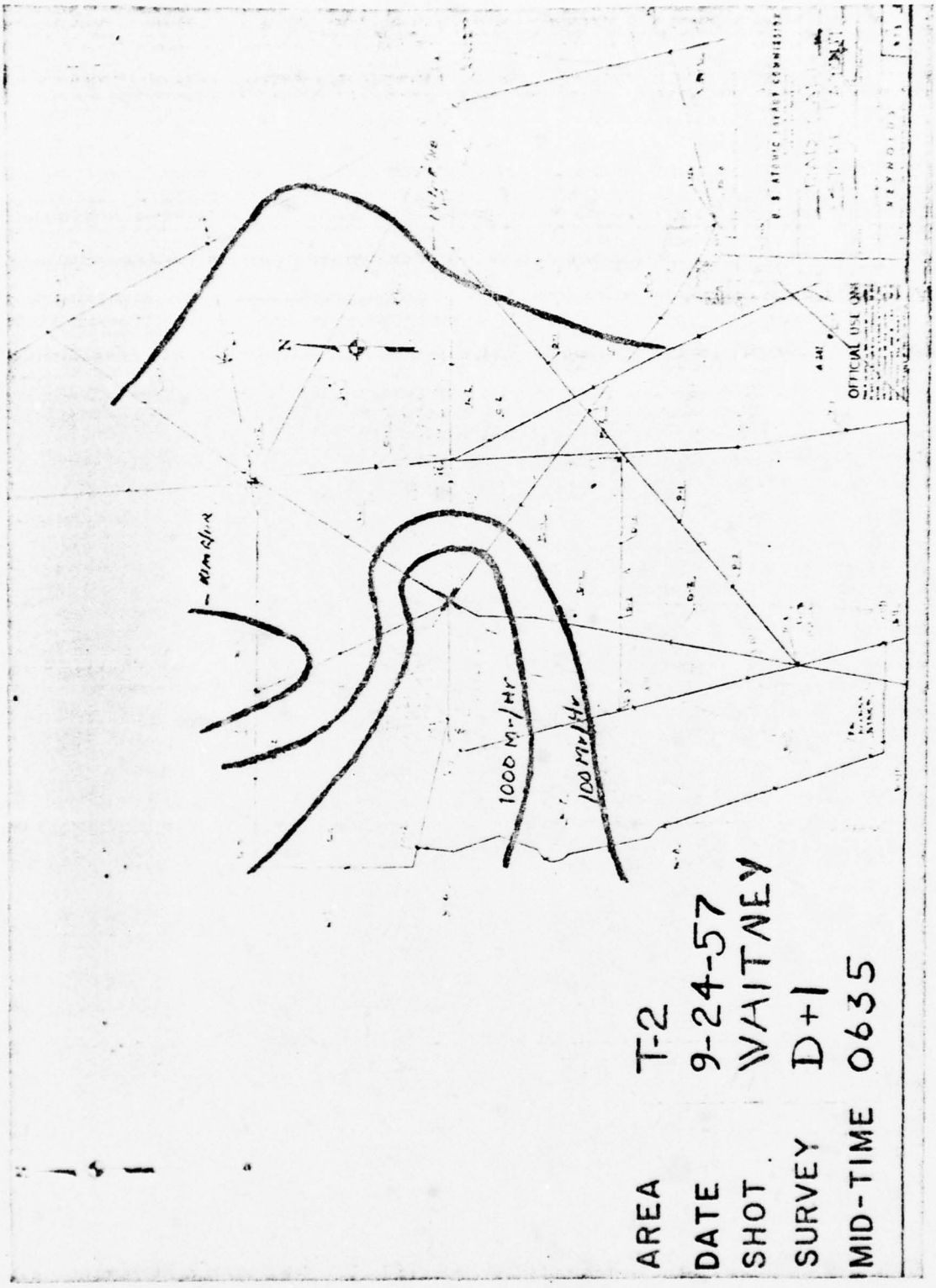

Figure 3.29.3 Whitney, D + 1

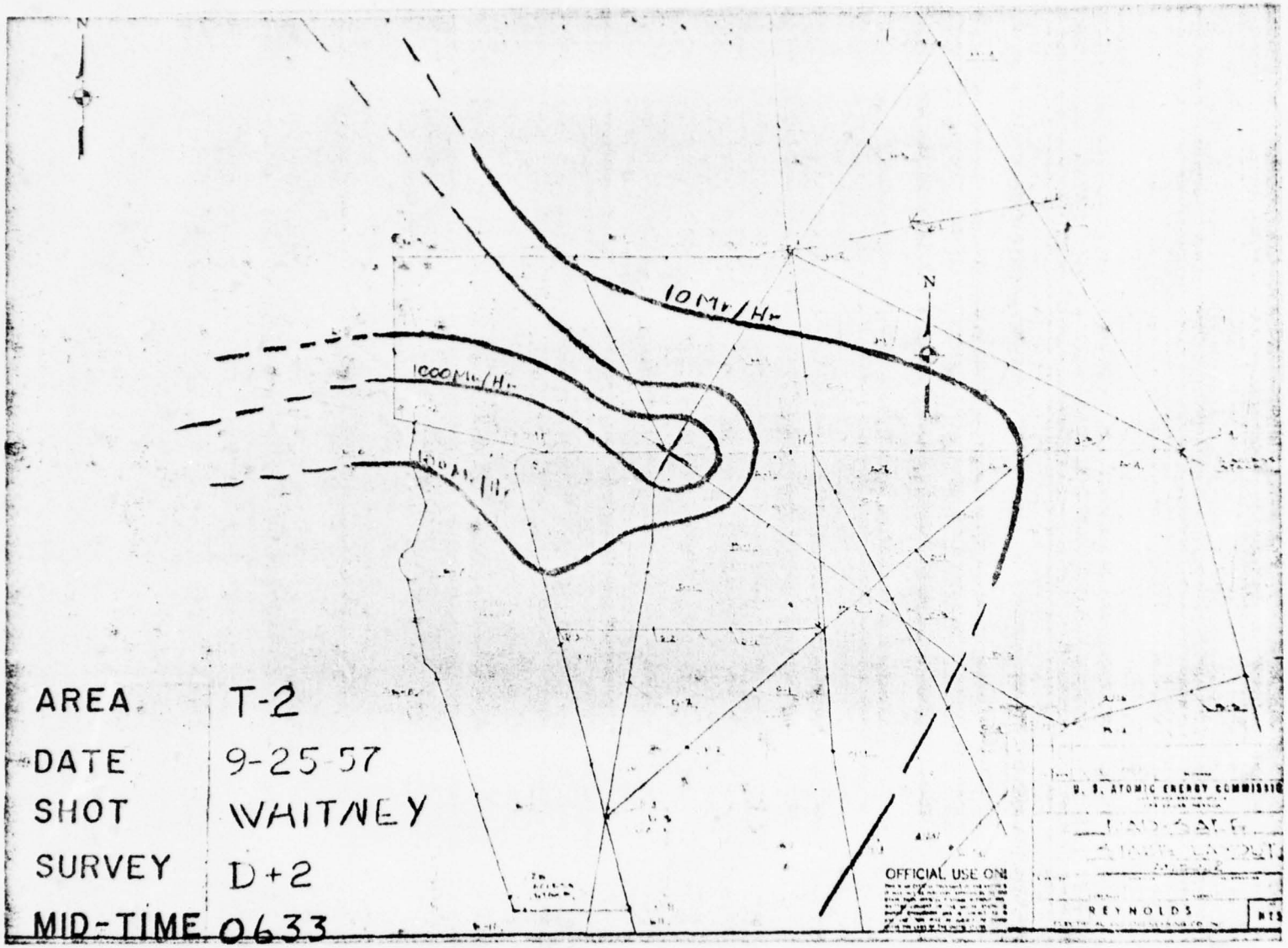

Figure 3.29.4 Whitney, D + 2

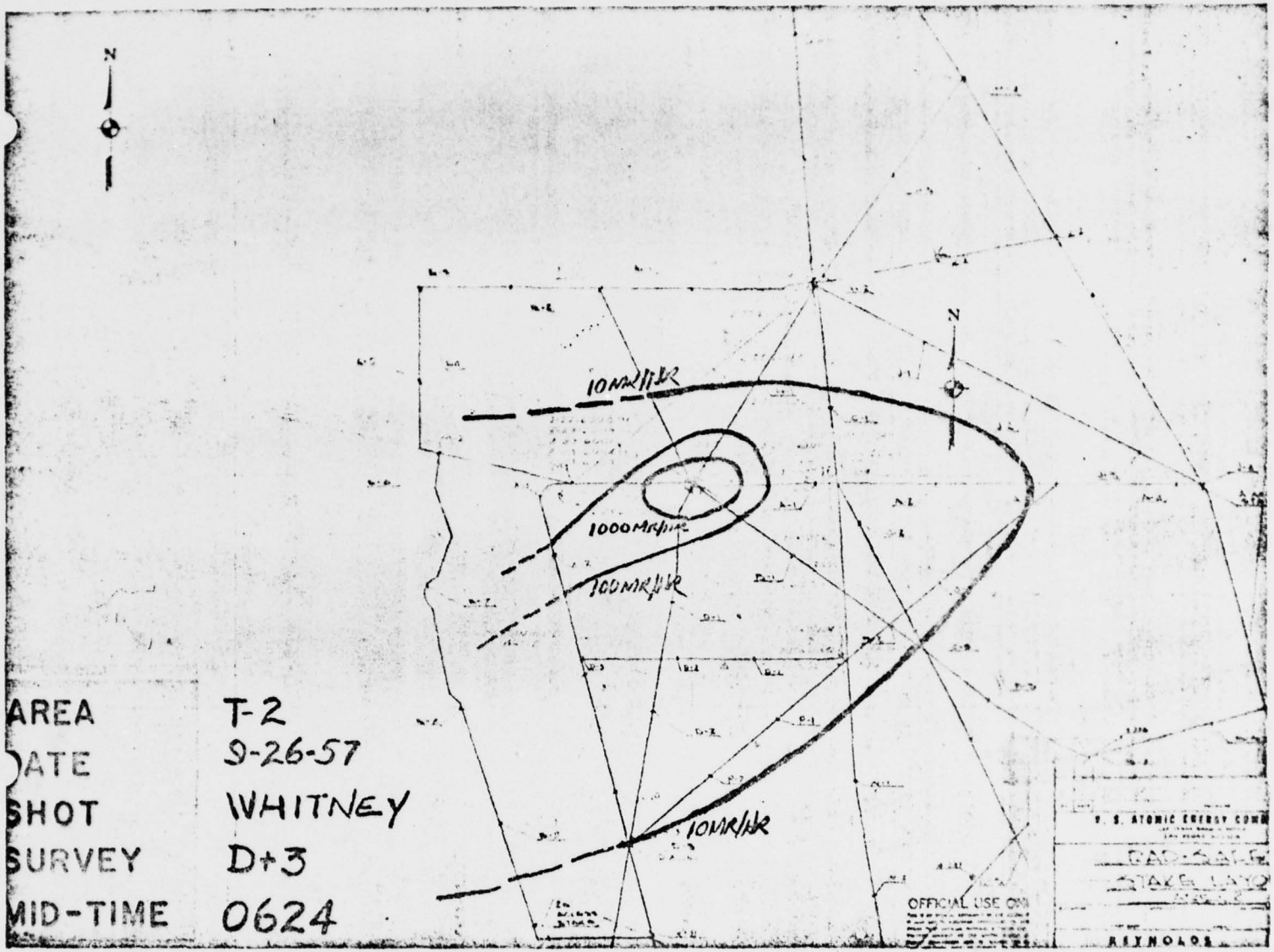

Figure 3.29.5 Whitney, D + 3

Fallout Trays:

Location	Long-Lived Alpha d/m per ft^2
Warehouse 6	Background
Well 5	Background
CP-2	Background
Gate 385	Background
Area 13	Background
Shot Area (Average)	7.2

No increase in radioactivity was noted in well and drinking water samples.

Radiation surveys in "clean working and living areas" in Mercury and the CP Area were negative.

Exposure data obtained from film badges placed at work locations from H-50 hours through H + 24 hours were as follows:

Location	Exposure mr
Area 13	63
Gate 385	185

The following samples were analyzed in the laboratory:

Type	Number
Air Samples	63
Nasal Swabs	47
Surface Swipes	132
Fallout Trays	47
Water Samples	7
Cloth Samples	4
Total	300

3.29.5 Training Branch

A two-hour refresher course in Rad-Safe procedures was given to two previously trained monitors from DOD, Project 6.5.

3.29.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
Sept. 22	50	128
Sept. 23	129	393

Date	Issued	Processed & Recorded
Sept. 24	75	340
Sept. 25	402	442
Sept. 26	260	341
Totals	916	1644

Dosimeters:

Date	Issued	Received
Sept. 22	8	8
Sept. 23	57	57
Sept. 24	26	26
Sept. 25	61	61
Sept. 26	14	14
Totals	166	166

3.29.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 480 people as follows:

Item	Number
Coveralls	302
Shoe Covers (pairs)	446
Respirators	188
Other Items	752

The laundry processed 2052 pieces of anti-contamination items.

3.30 Charleston (September 27 through October 5, 1957)

Charleston was a device fired from a balloon suspended 1500 feet above Area 9b. The device was detonated at 0600 hours on September 28, 1957. The cloud rose rapidly to 32,000 feet MSL and separated cleanly from the dust stem which began settling back immediately. The upper main portion of the cloud was blown generally in a northerly direction.

3.30.1 General Monitoring Branch

The aerial survey team departed at 0736 hours. Results obtained from this survey were as follows:

Intensity r/hr	Location	Altitude feet	Time hours	Area
15	Area 3b GZ	25	0743	3
8	Area 9 GZ	500	0749	9
25	Area 9 GZ	100	0750	9

Subsequent aerial re-surveys scheduled for H + 6 hours, D + 1, D + 2 and D + 3 days were cancelled because the necessary intensities could be obtained by ground survey teams.

The initial ground survey teams departed at 0605 hours. Results of the ground survey of non-shot areas were as follows:

Intensity mr/hr	Location	Time hours	Area
30	BJY	0617	Yucca Flat
75	Sub-Station 52	0635	Yucca Flat
8	7-300	0638	7
12	CETG Shelter	0646	2
7	Butler Building (New)	0648	8
45	2-380	0645	2
25	Ground Zero-Mesa	0735	12
8	12-300	0719	12
20	Lower Tunnel	0720	12
28	Upper Tunnel	0722	12

A check station to control access into the contaminated areas was established at the intersection of the Area 7-3b access road and the Mercury Highway.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
Sept. 28	D + 1/4	1213
Sept. 29	D + 1	0533
Sept. 30	D + 2	0625
Oct. 1	D + 3	0644
Oct. 3	D + 5	0700

One monitor was provided for project support.

3.30.2 Plotting and Briefing Branch

Results of the survey were plotted for display at various locations. (Figures No. 3.30.1 through 3.30.5).

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
Sept. 27	18	8	45
Sept. 28	34	10	90
Sept. 29	0	0	0
Sept. 30	13	5	36
Oct. 1	34	7	81

Date	Scheduled Parties	Projects Involved	Personnel Involved
Oct. 2	43	8	80
Oct. 3	24	5	63
Oct. 4	17	7	47
Oct. 5	5	5	12
Totals	188	55	454

3.30.3 Decontamination Branch

The following items were decontaminated at the CP-6:

Equipment	Number
Vehicles	29
Portable Generators	4
Portable Compressors	3

3.30.4 Special Assignments Branch

The following radioactive material was monitored and cleared for release from the Nevada Test Site:

Material	No. of Boxes	Agency
Sand Samples	185	ORNL*
Soil Samples	1	USGS
Filters	1	Sandia Corp.
Calibration Standards	1	CETG
Co^{60} Source	1	EG&G
7-ton Metal Door	1	CETG

* Oak Ridge National Laboratory

Two hundred thirty-two rental vehicles were monitored and cleared for release from the Test Site.

No significant radiation levels were encountered on the highway between the CP-2 and Mercury after the detonation.

Air-borne Radioactivity (D-day Averages):

Air Samples:

Location	Long-Lived Alpha d/m per M^3
Warehouse 6	Background
CP-2	0.1
Gate 385	Background
Area 13	0.2

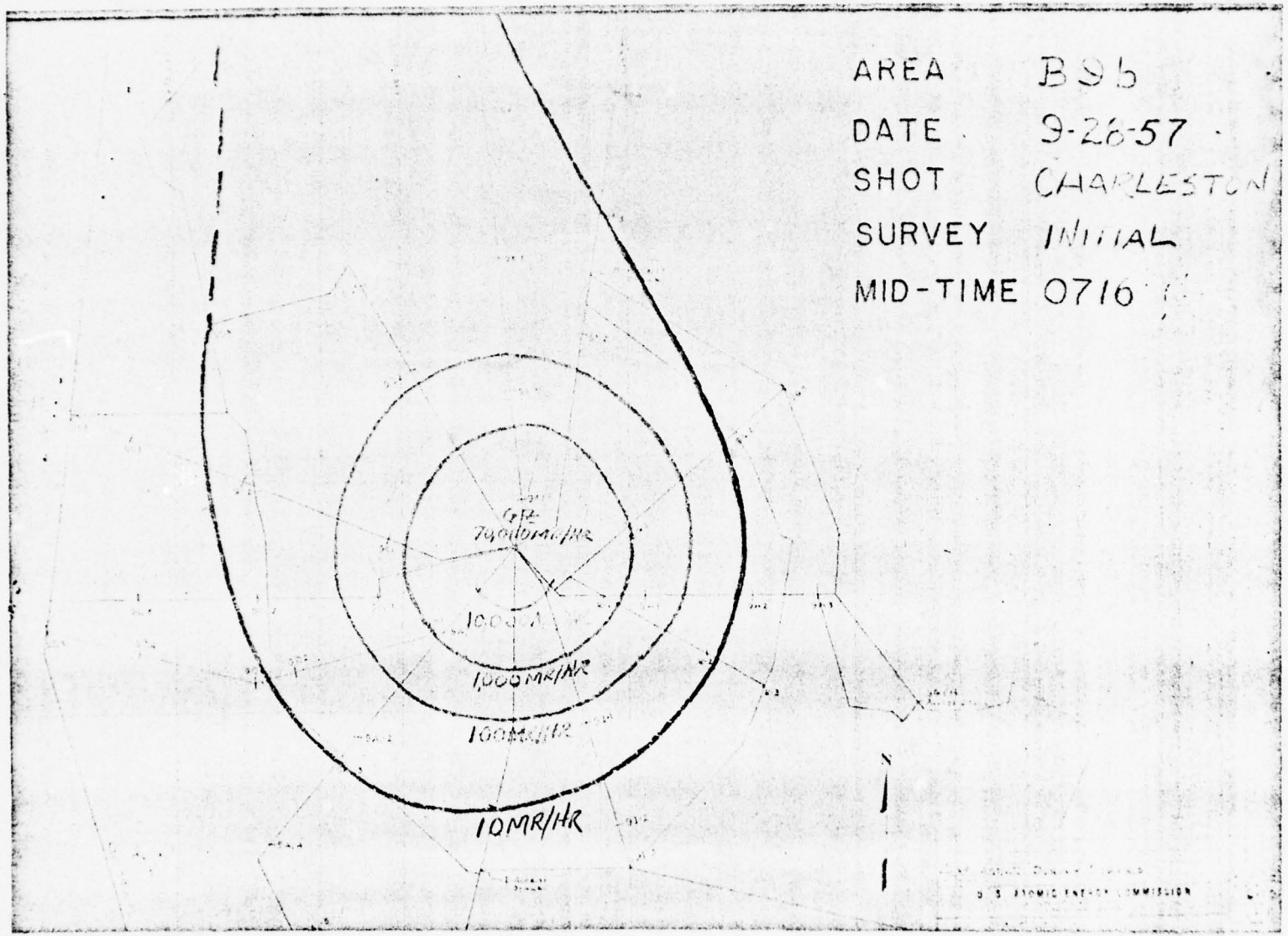

Figure 3.30.1 Charleston, Initial

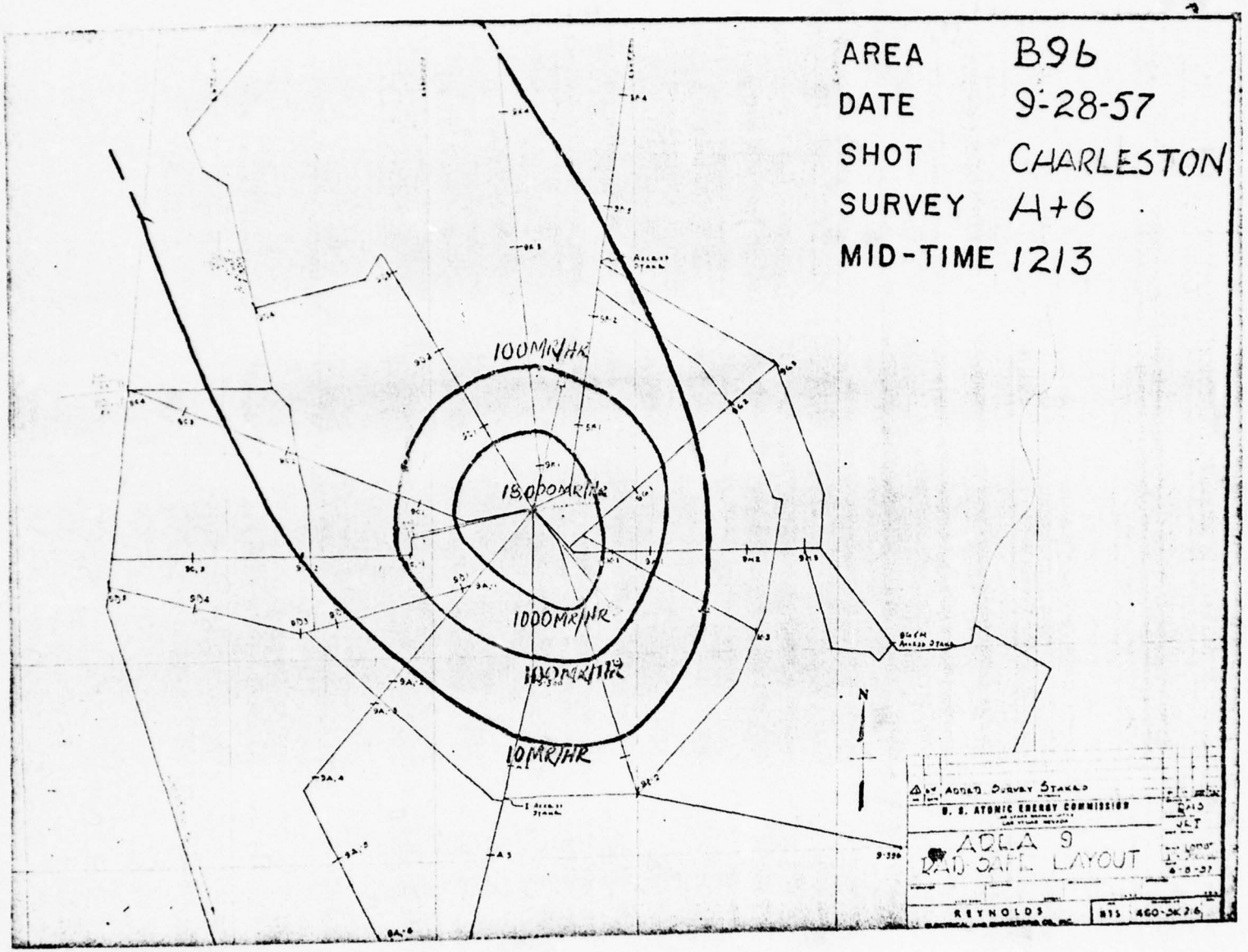

Figure 3.30.2 Charleston, H + 6

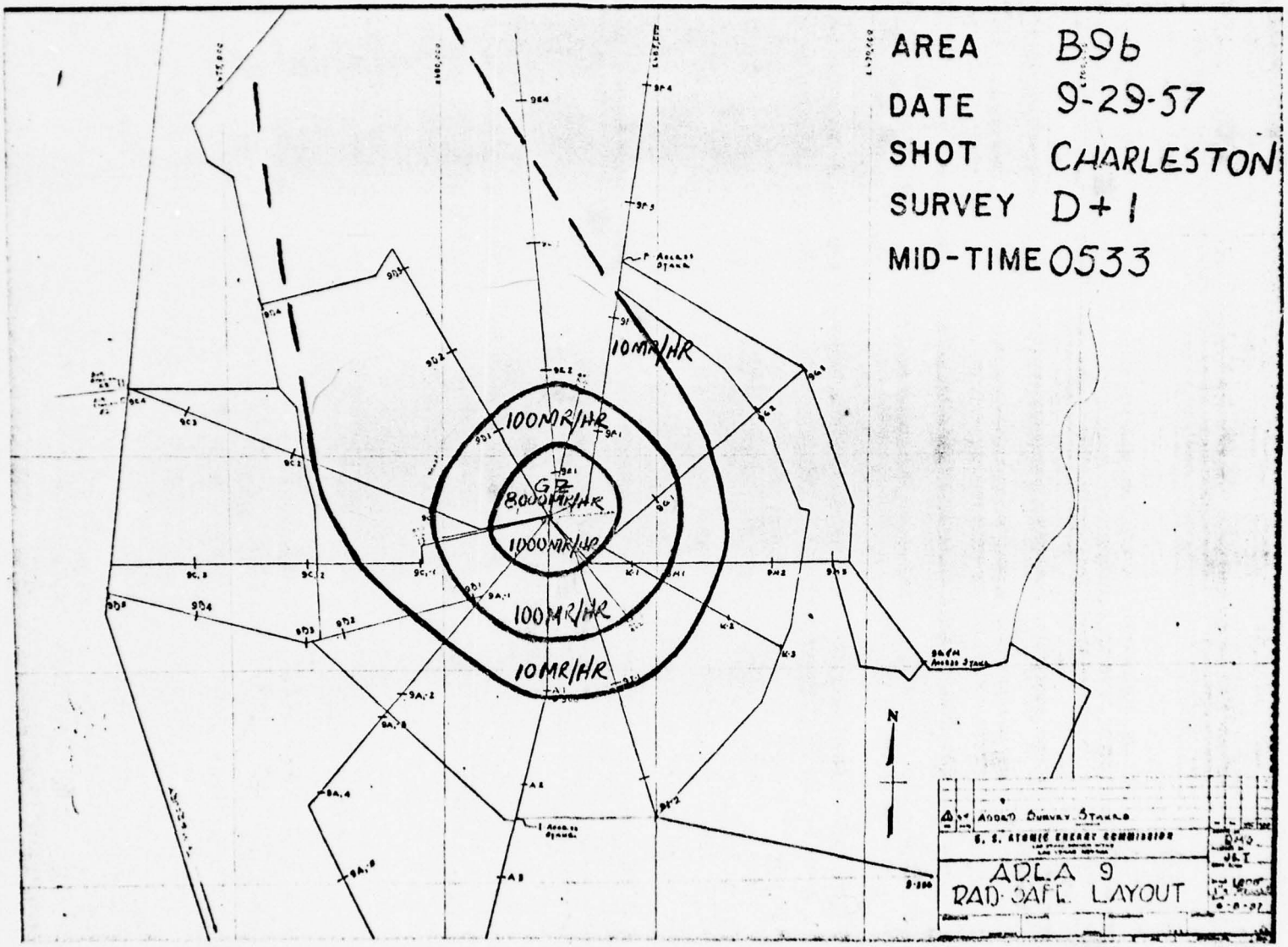

Figure 3.30.3 Charleston, D + 1

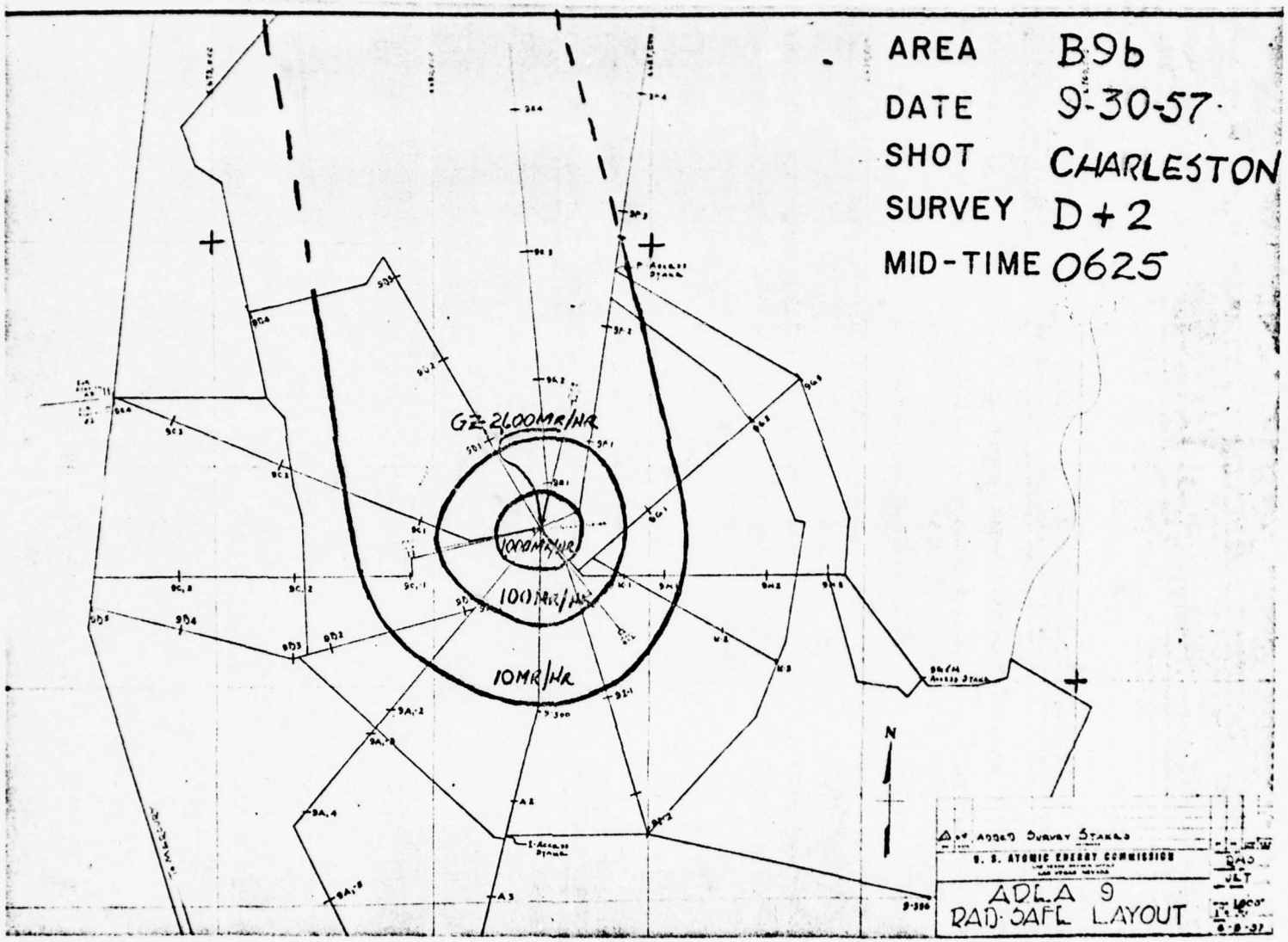

Figure 3.30.4 Charleston, D + 2

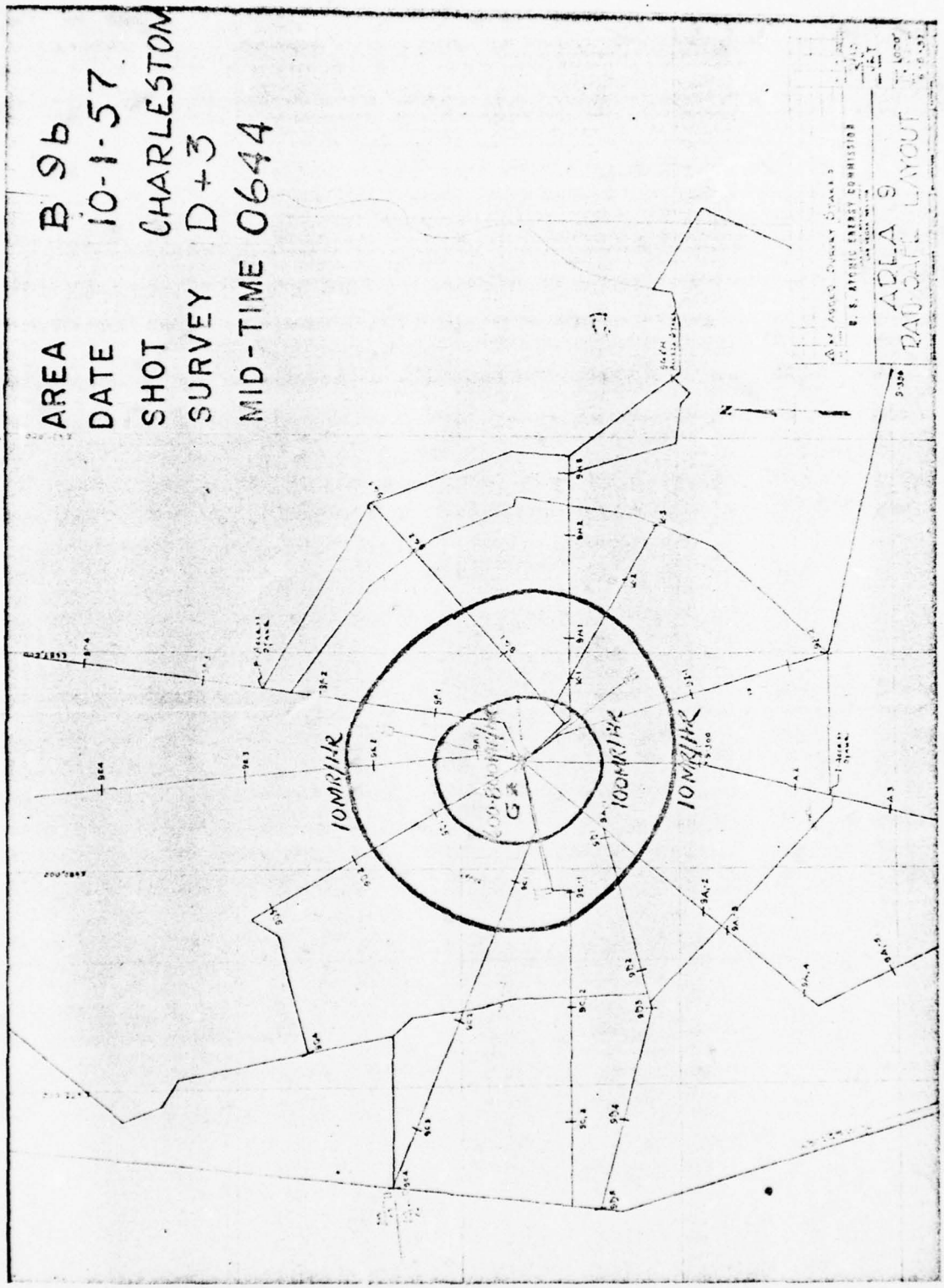

Figure 3.30.5 Charleston, D + 3

Fallout Trays:

Location	Long-Lived Alpha d/m per ft^2
Well 5	Background
CP-2	Background
Gate 385	Background
Area 13	Background
Gate 120	Background
Shot Area (Average)	4.0

No increase in radioactivity was noted in well and drinking water samples.

Radiation surveys of "clean living and working areas" indicated beta-gamma intensities of 20 mr/hr and greater on three vehicles in the AEC Motor Pool at Mercury. Vehicles were decontaminated to permissible levels.

The following samples were analyzed in the laboratory:

Type	Number
Air Samples	71
Nasal Swabs	77
Surface Swipes	395
Fallout Trays	116
Water Samples	7
Total	666

3.30.5 Training Branch

Routine duties were performed by the Training Branch.

3.30.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
Sept. 27	400	459
Sept. 28	2609	210
Sept. 29	92	182
Sept. 30	375	380
Oct. 1	560	609
Oct. 2	430	465
Oct. 3	346	167
Oct. 4	48	408
Oct. 5	14	76
Totals	4874	2956

Dosimeters:

Date	Issued	Received
Sept. 27	33	33
Sept. 28	60	60
Sept. 29	15	15
Sept. 30	12	12
Oct. 1	9	9
Oct. 2	16	16
Oct. 3	16	16
Oct. 4	12	12
Oct. 5	14	14
Totals	187	187

3.30.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 897 people as follows:

Item	Number
Coveralls	541
Shoe Covers (pairs)	761
Respirators	232
Other Items	1594

The laundry processed 4012 pieces of anti-contamination items.

3.31 Morgan (October 6 through October 12, 1957)

Morgan was a device fired from a balloon suspended 500 feet above Area 9b. The device was detonated at 0500 hours on October 7, 1957. It was the 24th and final full-scale nuclear detonation of the Plumbbob test series. The mushroom cloud quickly separated from its stem and rose to 40,000 feet MSL and moved in an easterly direction.

3.31.1 General Monitoring Branch

The aerial survey team departed at 0630 hours. Results obtained from this survey were as follows:

Intensity r/hr	Location	Altitude feet	Time hours
75	Area 9b GZ	500	0640
7	Area 3b GZ	25	0648

Subsequent aerial re-surveys scheduled for H ∕ 6 hours, D ∕ 1 and D ∕ 2 days were cancelled because the necessary intensities could be obtained by ground survey teams.

The initial ground survey teams departed at 0505 hours. Results of the ground survey of non-shot areas were as follows:

Intensity mr/hr	Location	Time hours	Area
25	3-300	0516	3
40	BJY	0520	Yucca Flat
100	7-300	0525	7
10	2-380	0527	2
360	Area 7 GZ	0529	7
21	1-300	0528	1
14	4-380	0642	4
12	Mesa	0605	12
10	Sub-Station 52	0525	Yucca Flat

A check station to control access into the contaminated areas was established at the intersection of the Area 3b access road and the Mercury Highway.

Re-surveys of the shot area were made as follows:

Date	Re-survey days	Mid-time hours
Oct. 7	D / 1/4	1112
Oct. 8	D / 1	0648
Oct. 9	D / 2	0700
Oct. 10	D / 3	0928

3.31.2 Plotting and Briefing Branch

Results of the surveys were plotted for display at various locations. (Figures No. 3.31.1 through 3.31.5).

Briefings were conducted and area access permits were certified for each party as follows:

Date	Scheduled Parties	Projects Involved	Personnel Involved
Oct. 7	10	4	39
Oct. 8	10	7	36
Oct. 9	5	4	18
Totals	25	15	93

3.31.3 Decontamination Branch

The following items were decontaminated at the CP-6:

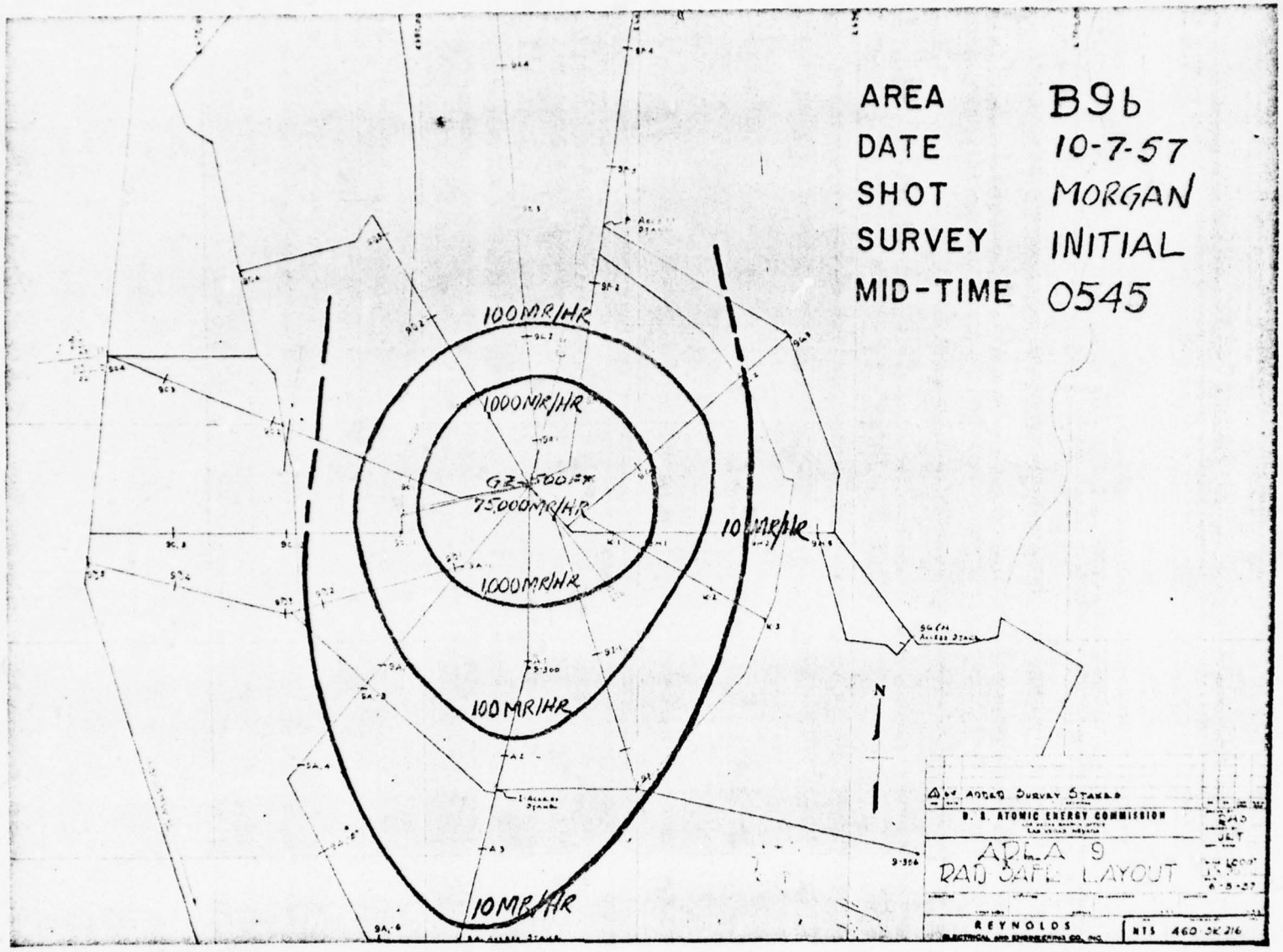

Figure 3.31.1 Morgan, Initial

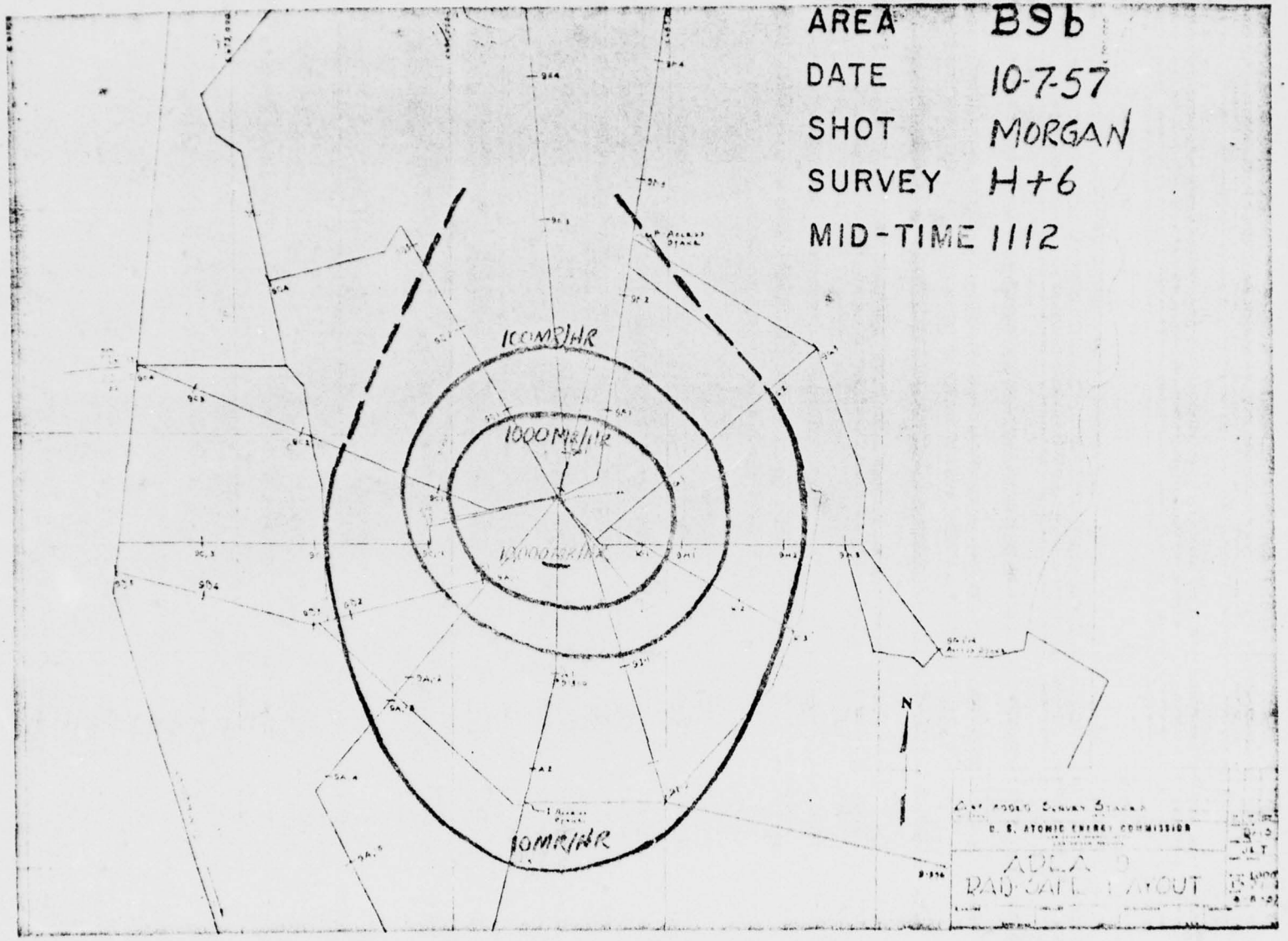

Figure 3.31.2 Morgan, H + 6

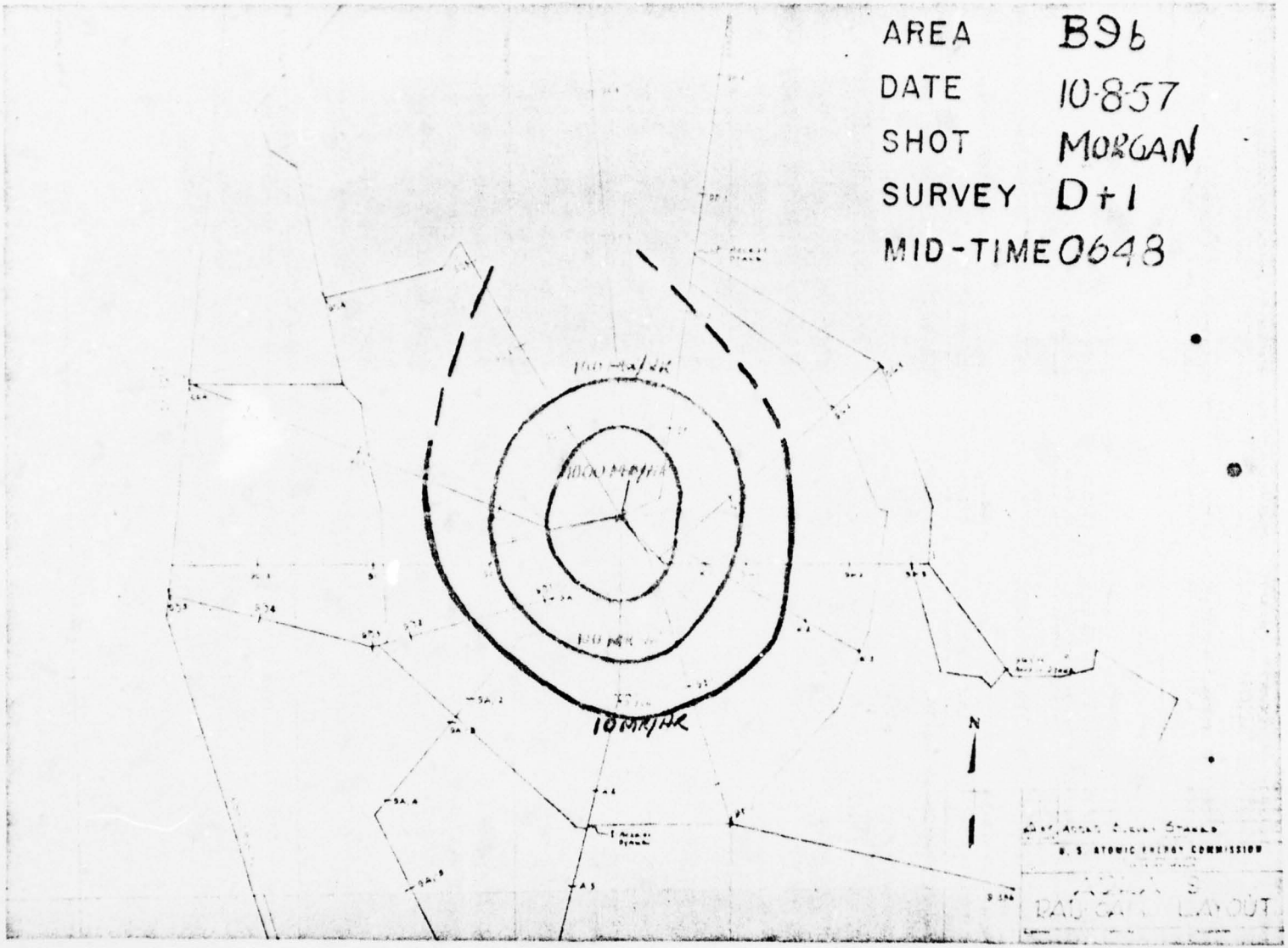

Figure 3.3.1.3 Morgan, D + 1

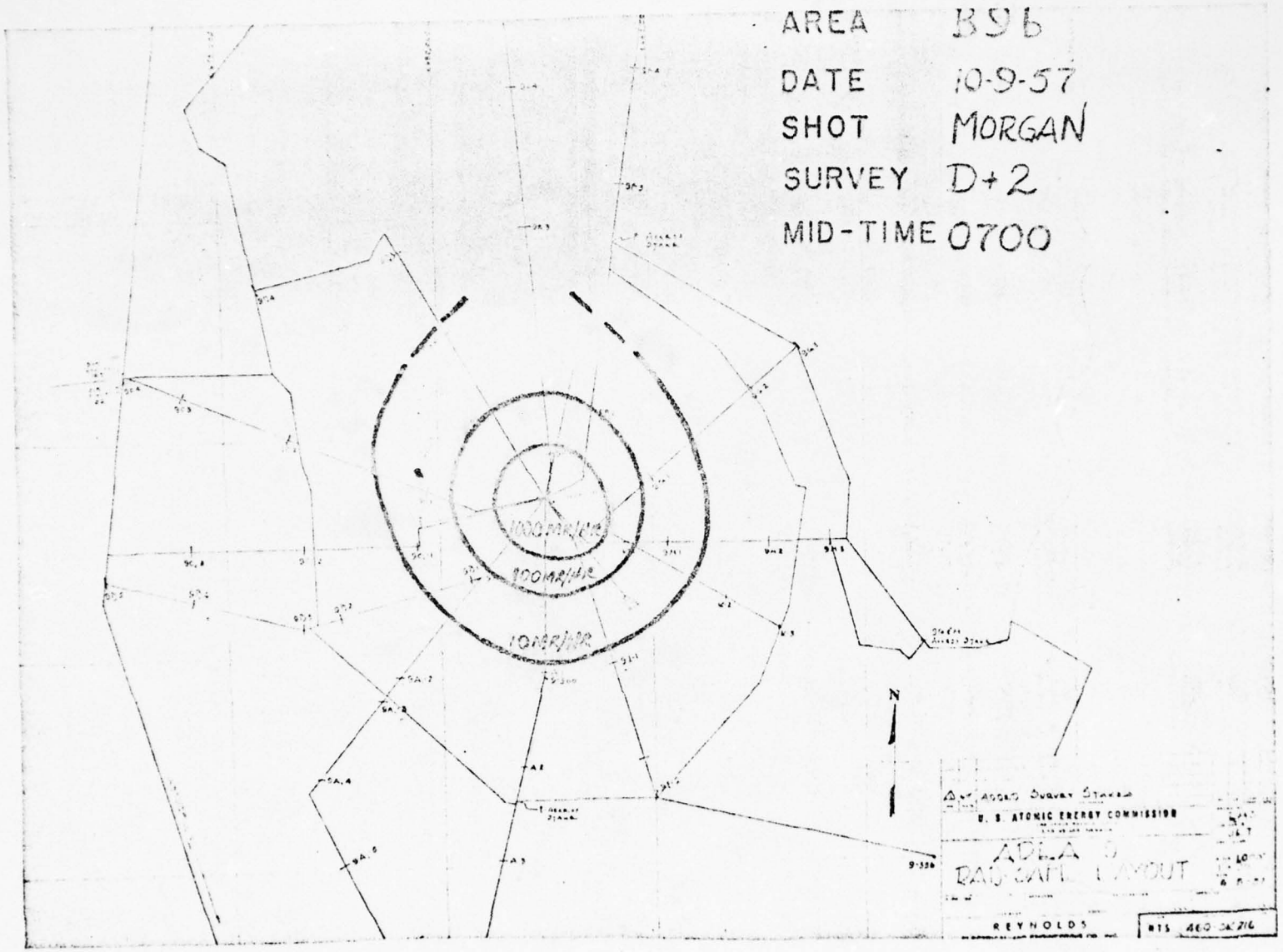

Figure 3.31.4 Morgan, D + 2

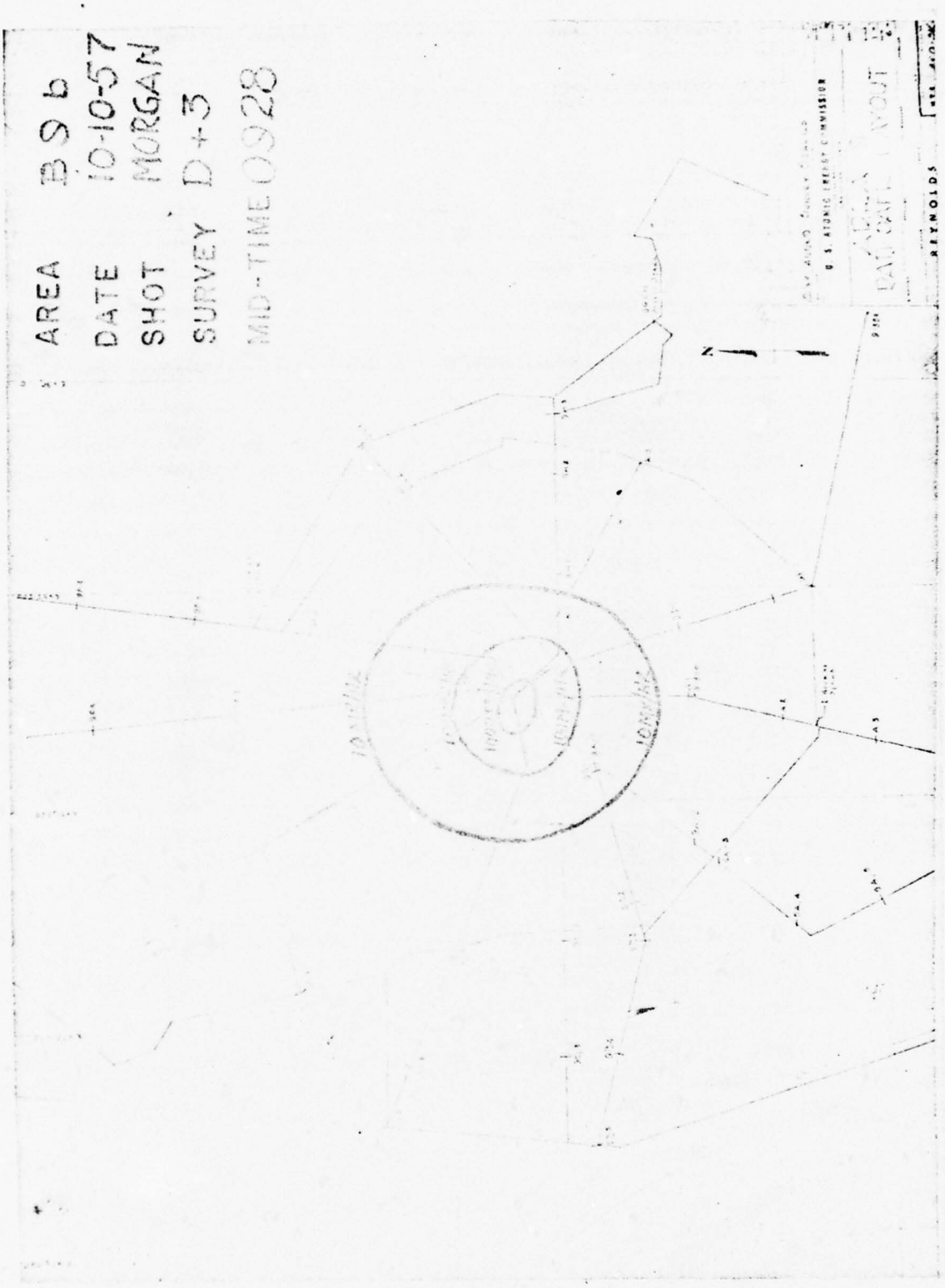

Figure 3.31.5 Morgan, D + 3

Equipment	Number
Vehicles	33
Generators	2
Trailers	3

3.31.4 Special Assignments Branch

The following radioactive material was monitored and cleared for release from the Nevada Test Site:

Material	No. of Boxes	Agency
260 mc Co^{60} Source	1	CETG
32mc Co^{60} Source	1	CETG
Po Be Source (8×10^6 n/sec)	1	UCRL

No significant radiation levels were encountered on the highway between the CP-2 and Mercury after the detonation.

Air-borne Radioactivity:

Air Samples: (D-day Averages)

Location	Long Lived-Alpha d/m per M^3
Warehouse 6	Background
CP-2	0.1
Gate 385	0.1
Area 13	Background

Fallout Trays: (D-8 to D / 4 Averages)

Location	Long-Lived Alpha d/m per ft^2
Well 5	Background
CP-2	Background
Gate 385	Background
Area 13	Background
Gate 120	Background
Shot Area (Average)	Background

No increase in radioactivity was noted in well and drinking water samples.

Radiation surveys in "clean working and living areas" in Mercury and the CP Area were negative.

The following samples were analyzed in the laboratory:

Type	Number
Air Samples	42
Nasal Swabs	40
Surface Swipes	134
Fallout Trays	31
Water Samples	12
Total	259

3.31.5 Training Branch

Routine duties were performed by the Training Branch of the Rad-Safe Division.

3.31.6 Personnel Dosimetry Branch

The following dosimetry services were provided:

Film Badges:

Date	Issued	Processed & Recorded
Oct. 6	34	165
Oct. 7	126	134
Oct. 8	42	329
Oct. 9	26	80
Oct. 10	19	409
Oct. 11	39	119
Totals	286	1236

Dosimeters:

Date	Issued	Received
Oct. 6	16	16
Oct. 7	56	56
Oct. 8	29	29
Oct. 9	17	17
Oct. 10	20	20
Oct. 11	9	9
Totals	147	147

3.31.7 Logistics Branch

Anti-contamination clothing, materials and supplies were issued to 249 people as follows:

Item	Number
Coveralls	149
Shoe Covers (pairs)	201
Respirators	62
Other Items	486

The laundry processed 2778 pieces of anti-contamination items.

Chapter 4

Summary of Support Services

The following paragraphs summarize the support services provided by each Rad-Safe Branch:

4.1 General Monitoring Branch

Type of Work	Number Performed
Initial Surveys (shot areas)	26
Initial Surveys (non-shot areas)	406
Re-surveys	496
Survey Readings Reported	25,460
Warning Signs and Barricades Placed	6,336
Check Stations Initiated	60
Man-hours of Check Station Operation	5,280
Personnel Cleared through Check Stations	25,600
Pre-scheduled Party Monitors Assigned	231

4.2 Plotting and Briefing Branch

Type of Work	Number Performed
Access Permits Issued	7,712
Personnel Briefed	24,512
Original Survey Overlays	448
Copies of Survey Overlays	1,312
Secondary Plotting Facilities Initiated	32

4.3 Decontamination Branch

Type	Number
Vehicles	1,980
Heavy Equipment	132
Miscellaneous Items	460

4.4 Special Assignments Branch

Two-hundred fifty-eight boxes of radioactive material were packaged and shipped. Samples collected and analyzed were as follows:

Type	Number
Nasal Swabs	4,230
Facial Swipes	109
Water Samples	151
Air Samples	1,945
Fallout Trays	1,727
Surface Swipes	6,405
Soil Samples (not analyzed)	127

4.5 Training Branch

Type of Instruction	No. of Sessions	No. of Personnel
Indoctrination Lectures to New Employees	380	2100
Orientation Lectures to Touring Groups	15	306
Re-orientation Lectures to other Agency Monitors	18	174
Official Observer Lectures	17	805
Three-day Monitor Training Courses	17	280

The following documents were published:

Basic Radiological Safety Training Manual.
Standard Operating Procedure for REECO Rad-Safe Division.
Radiological Safety Handbook for NTS.
Articles for NTS Plumbbob newspaper.

4.6 Personnel Dosimetry Branch

Film badges were processed and exposures reported on more than 9000 personnel during Operation Plumbbob. Film badges and dosimeters handled were as follows:

Type	Number
Film Badge Packs Issued, Processed and Recorded	74,500
Pocket Dosimeters Issued and Read	15,000

4.7 Logistics Branch

Type	Number
Urine Sample Kits Issued	73
Nasal Swabs Issued	4230
Shoe Covers Issued (pairs)	24,331
Coveralls Issued	14,824
Respirators Issued	10,755
Miscellaneous Items Issued	42,364
Laundry Items Processed	102,799
Work Requests Processed	148
Vehicles Provided	30

Chapter 5

Special Reports

5.1 Radiation Exposures

5.1.1 External, Gamma

A total of 44 personnel received exposures in excess of the guides established by the Test Manager for Operation Plumbbob.

These exposures are tabulated below:

No. of Personnel	Above Guide 3r/quarter	Above Guide 5r/year	Reason
3	Yes	Yes	Authorized 15 rem/quarter by Test Manager
16	Yes	Yes	Authorized 7.5 r by Test Manager
2	Yes	No	Authorized 7.5 r by Test Manager
1	Yes	No	Authorized 4 r/quarter by Test Manager
2	Yes	Yes	Test Aircraft Unit Personnel
4	Yes	No	Test Aircraft Unit Personnel
16	Yes	No	Explanation Listed Below*

*Reasons for accumlated individual exposures in excess of 3 r per quarter received by 16 personnel under REECO Rad-Safe Control are as follows:

Five personnel received over-exposures because the pilot of an initial survey helicopter disregarded the instructions of accompanying Rad-Safe monitors to fly out of a high radiation intensity field.

Six personnel of various participating laboratories received over-exposures accumulated in small dosages during the performance of recovery missions.

Two NRDL personnel received over-exposures when they disregarded Test Director regulations by performing recovery in a radiation field exceeding 10 r/hr.

One of the U.S. Army's Rad-Safe Support Unit personnel, assigned to an off-site project, received a slight accumulated over-exposure.

Two Chemical Warfare Laboratory, (CWL), personnel failed to properly shield samples during their return trip to the Control Point Area.

5.1.2 Internal Exposures

Four instances of possible internal exposure occurred at the Nevada Test Site during Operation Plumbbob. In all instances, dose rate readings and laboratory analysis of body fluid indicated no significant exposure. The exposures can be summarized as follows:

Escape of radioactive gas from the Tower 2-A cab contaminated the working area and 12 personnel were exposed.

One person removed his respiratory protective device while working in an area highly contaminated with alpha emitting material.

Several personnel were exposed while removing and cutting a cable highly contaminated with alpha emitting material.

Four personnel without respiratory protection entered a tunnel which was highly contaminated with alpha emitting material. They left immediately upon detecting the contamination.

5.1.3 Exposure Study, Gamma

Tabulation of dosimetry records by IBM began on April 1, 1957. A study of accumulated individual gamma exposures covering the period April 1, 1957, through January 1, 1958, provided the following data:

Exposure mr	No. of Personnel	Percent of Total Personnel
0	4,724	46.5
1 - 99	1,794	17.5
100 - 499	1,895	19.1
500 - 999	690	6.1
1,000 - 4,999	1,015	10.0
5,000 - above	22	0.2

The 10 highest accumulated individual exposures during 1957 were as follows:

1. 10,105 milliroentgens
2. 9,845 milliroentgens
3. 7,000 milliroentgens
4. 6,785 milliroentgens
5. 6,385 milliroentgens
6. 6,370 milliroentgens
7. 6,345 milliroentgens
8. 6,120 milliroentgens
9. 6,025 milliroentgens
10. 5,935 milliroentgens

5.2 Large Area Decontamination

5.2.1 Introduction

Several ground zero areas were decontaminated to allow preparations for succeeding shots to proceed without costly delays. Radiation intensities were reduced to safe working levels while exposures to decontamination personnel were kept to a minimum. The general procedures followed in the decontamination operations, conclusions reached by evaluation of the data and the report on a typical area decontamination are listed in the following paragraphs:

5.2.2 Procedures

Areas where technicians would be working and where decontamination would be required were specified by Test Director personnel. The selected areas were monitored and exposure time limits computed. Knowledge of types and amounts of activity present was required to determine the most economical method of decontamination. A general operation involved a combination of removing debris, scraping and removing soil, and back filling with uncontaminated soil. The air-borne radioactivity was minimized by wetting down the area during each decontamination

operation. Personnel were required to wear anti-contamination clothing, and respirators whenever the area had an excess of air-borne dust. Exposures were controlled by observing dosimeter readings. Film badges were exchanged after each work day and dosages recorded separately to obtain data for future operations. The areas were monitored after the decontamination operation to assure sufficient reduction in radiation intensity and to determine the efficiency of specific combinations of methods.

5.2.3 Data

An analysis of data collected during the decontamination of large land areas on the Nevada Test Site resulted in the following conclusions:

Decontamination Method	Decontamination Factor $(I_o/I)^*$
For fallout contaminated areas:	
Scrape - 6 inches of soil (no fill)	4
Fill with 8 inches of soil (no scraping)	4
Scrape 6 inches of soil and fill with 6 inches of soil	6
For areas of Neutron-induced soil activity:	
Scrape - 12 inches of soil	3
Scrape 6 inches of soil and fill with 6 inches of soil	2

* I_o = Initial dose rate levels
  I = Final dose rate levels (corrected for decay)

It was interesting to note that a "Rule of Thumb" calculation was obtained from the area decontamination operations. An average dose to working personnel can be calculated by multiplying one half of the initial dose rate by the time required for the decontamination. The initial dose rate is an average dose rate measured at waist level over the area under consideration.

Decay studies and radiation spectrum analysis indicated that activity in areas of balloon detonated weapons is primarily soil induced (sodium and manganese). In areas of tower detonations, the activity appeared to be a mixture of soil and iron induced activity and fission product material.

5.2.4 Detailed Report

A report on a typical large area decontamination is included as an Appendix at the end of this report.

5.3 Personnel Dosimetry Studies

5.3.1 IBM Evaluation

Tabulation of dosimetry records by data processing machines was initiated during this operation. The IBM equipment was located at the REECO Las Vegas Office.

The increase in operational efficiency can be shown by a comparison of manual and IBM method of providing dosage records and reports.

Job Description	Man-hours/week
IBM	
Transportation of Cards	42
Key Punching	42
Machine Operation	20
Distribution of Reports*	32
Total	136

* This can be eliminated almost entirely by utilizing special tabulating paper.

Manual	
Recording on Dosage Cards	210
Summarizing Dosages	150
Sorting and Alphabetizing	160
Typing and Distribution	560
Total	1080

The equipment expense should be approximately equal for either method. The automatic recording and reporting method has many advantages such as:

(1) Accuracy
(2) Ease of statistical analyzing results
(3) Flexibility and ease in making many copies of the reports
(4) Short time from data to report compilation
(5) Complete file available for tabulating reports very rapidly
(6) Many intangible benefits; i.e., ease of mind concerning accuracy of computations, spelling, etc.

During the month of June 1957, 14,000 film badges were processed by the IBM system for $1.71 per film badge. The cost breakdown is as follows:

Item	Percent of Total Cost
Film Badge	9.5
Wage Expense*	81.5
Equipment and Supplies	9.0

* This includes administrative cost and cost of transporting cards to Las Vegas.

It is estimated that four times this number of film badges could be handled with no increase in wage or equipment cost. This would result in a cost per film badge of $0.55.

5.3.2 Film Badges and Processing

The Personnel Dosimetry Branch began re-activation of the CP-2 dosimetry facilities in October of 1956 in preparation for Operation Plumbbob. Many changes were made in the processing procedures and equipment to increase the accuracy and efficiency of the system. The water-cooled condensers of the De Alva processing equipment had become scaled to the point that temperature control was no longer reliable. An air-cooled condenser, which required no maintenance, was used as a replacement and proved to be very satisfactory.

The difficulties with variable density values of batch control and standard films encountered at the beginning of the operation were traced to two causes; the inherent instability of the processing chemicals, and the chemical breakdown of the developing solution caused by materials used in faulty assembly of new processing trays. These trays were taken out of service and all of the processing equipment cleaned thoroughly. The Kodak liquid X-ray solutions were replaced with comparable DuPont solutions since the DuPont solutions had more favorable characteristics. These changes resulted in uniformity of control procedure and a longer life of the processing solutions.

Film badge evaluation studies before and during the operation were made for the purpose of finding the best overlap in the 5 to 12 roentgen dosage range. The following film pack components were evaluated:

DuPont Types 502, 510, 555, 824, 825, 834, 606 and Eastman Type 2.

The 502 and 834 components provided the best overlap. However, use of the DuPont Film Pack Type 559 (502 and 606 components) was continued at NTS since it provided sufficient accuracy and overlap when processed with DuPont developer.

Chapter 6

Conclusions and Recommendations

6.1 Vehicles

Vehicles which became inoperable or damaged by rough terrain while in a high radiation intensity field had to be abandoned. Personnel were either rescued or had to walk out by the shortest route. This resulted in high exposure to the personnel, serious delays in reporting survey data, and additional exposure and expense in recovering and repairing the damaged vehicles.

Faster and more accurate reporting of Rad-Safe survey data, less radiation exposure to personnel, and savings in maintenance costs can be obtained by using six 3/4 ton pick-ups with 4-speed transmission. One-half ton pick-ups are not adequate or safe for use in survey work over rough terrain.

6.2 Communications

Many radio "dead spots" existed in the shot areas making it impossible to either receive or transmit to the Control Point. Consequently, field teams spent a large portion of their time relaying information for other teams. This distracted them from their own work, and caused confusion and delays.

Many important decisions on the part of test personnel and support groups are dependent on radiation readings reported from the field by radio. Survey teams are inter-dependent on radio transmissions in order to do their work efficiently while keeping their exposure to a minimum.

Better and more orderly reporting of survey data, more efficient dispatching of recovery and work parties, and less confusion at the Control Point areas can be obtained by operating the radio net on a duplex rather than a simplex system.

6.3 Aerial Surveys

The aerial surveys are of relatively little value and are extremely costly. It is more practical and less expensive to obtain the needed data by use of a telemetering system or by vehicle surveys.

6.4 Field Monitors

There was frequent hesitancy on the part of test personnel and field workers to immediately accept and observe advice from monitoring personnel. There were two primary reasons for this. Field and test personnel, intensely interested and absorbed by the work at hand, did not immediately recognize a monitor as such. Consequently, they would momentarily resent an interruption and not understand the necessity for it. Monitors, on the other hand, equally determined to carry out their responsibilities, were too abrupt in their contacts and often failed to identify themselves before suggesting the observance of Rad-Safe procedures.

Better field relations and improved service to all users can be obtained by establishing visible identification for Rad-Safe field personnel. It is recommended that distinctive coveralls and caps with a Rad-Safe patch be provided all field monitors.

6.5 Rad-Safe Representatives

Improved knowledge of procedures by all test group personnel, with less confusion and unnecessary delays, can be effected by having all Rad-Safe representatives

participate in the over-all Rad-Safe program. Special emphasis should be placed on the indoctrination and training of personnel assigned to their respective test groups, as well as effective distribution and use of daily Rad-Safe procedures bulletins, radex maps, and personnel exposure reports.

There were many delays caused by repetitious and unnecessary requests for routine information or special service. This was generally caused by ignorance of established procedures or the readily available sources of information.

6.6 Construction Personnel

There was not a sufficient awareness on the part of construction personnel of the radiological hazards in the shot areas or of Rad-Safe procedures. It is recommended that all support construction personnel be indoctrinated in Rad-Safe procedures and furnished with a pocket size booklet containing a check list of these procedures. Construction supervisors should have a one-day orientation on proper Rad-Safe procedures.

Radiation Exposure Reports

Confusion and errors in reports were caused by assignment of identification numbers to individuals who did not have either a military or Social Security number. A few persons who made several trips to the Nevada Test Site did not retain their original charge-a-plates. They were mistakenly assigned new numbers, thereby causing their dosage records to be tabulated erroneously. It is recommended that all contractor or user employees at the Nevada Test Site acquire Social Security numbers for dosage recording purposes.

Appendix I

REPORT ON DECONTAMINATION OF AREA 9 BALLOON SITE

September 1957

INDEX

Introduction

Radioactive fallout from the Area 2c Smoky shot, detonated at 0530 hours on August 31, 1957, contaminated the Area 9 balloon site. Since preparations were in progress for a detonation in Area 9, decontamination in the immediate vicinity of the Area 9 balloon site ground zero was necessary to protect workers from over-exposure to radiation. The decontamination operation started at 1000 hours on September 3, 1957.

I. Prior to Decontamination

A. Original Condition of Area

1. Gamma levels in the Area 9 balloon site averaged 105 mr/hr at waist level and 120 mr/hr at near ground contact.
2. The source of radioactivity appeared to be fallout of mixed fission products from the Area 2c Smoky detonation.

B. Decontamination Plan

1. The area to be decontaminated was the surface area within approximately a 100-foot radius of ground zero.
2. Decontamination was to be accomplished by scraping the surface soil, removing it from the area, and back filling with soil from a "clean" area.
3. Contaminated soil removed from the area was to be dumped at a sufficient distance so that the material would not be a continued source of radiation.
4. Water was to be sprayed over the area periodically to minimize dust and to settle radioactive particles.
5. A radiological survey was to be conducted prior to decontamination for comparison with post-decontamination levels to determine the efficiency of the operation.
6. Personnel were to be advised on the anti-contamination clothing required and the estimated dosages which they would receive.
7. A personnel log was to be maintained to document time spent in the area and the type of work performed. Film badges were to be evaluated to provide information for estimating dosages during subsequent decontamination operations.
8. A log was to be maintained of the vehicles and equipment in the area. Filter paper swipes were to be taken to ascertain the extent of equipment contamination.
9. Air samples were to be taken before, during and after each phase of decontamination to determine the concentrations of air-borne activity.
10. Radiation readings were to be taken after each phase of the operation to determine the efficiency of each phase.

II. Decontamination Operations

A. Equipment and Personnel

1. Equipment utilized for decontamination included one grader for scraping the topsoil and leveling the fill dirt; one automatic loader for loading the contaminated dirt; five dump trucks for transporting contaminated dirt from the area and hauling uncontaminated dirt to the area; and one water truck to spray the area.

2. Personnel required for the operation were two equipment operators, six truck drivers, seven laborers, two foremen and one superintendent.

B. Use of Grader

1. The grading operation commenced at 1015 hours and continued until 1700 hours.
2. The areas scraped are shown on the Decontamination Area Map, Figure A. 1.
3. The topsoil was removed to an average depth of six inches and deposited in piles averaging 100 feet long and two feet high. An exception was the 60-foot square oil pad approximately 50 feet south of the Greenhouse (ground zero cab) where the grader scraped to an average depth of one inch.
4. The fill dirt on both scraped and unscraped areas was leveled by the grader to an average depth of eight inches. This is shown in Figure A. 1.
5. The area west of the Greenhouse was not scraped because scraping could have damaged the signal cable.
6. The grader operator wore full anti-contamination clothing less the respirator.

C. Use of Loader

1. The automatic loader worked in the area from 1130 to 1300 hours and from 1430 to 1530 hours.
2. The piles of contaminated dirt were scooped and conveyed into dump trucks as the loader moved the length of each pile.
3. The loader also scooped the top four to six inches of dirt from the slanted entrance to the bunker.
4. Extremely dusty conditions were created when the dirt dropped from the conveyor belt into the dump trucks.
5. The loader operator was dressed in full anti-contamination clothing including respirator.

D. Use of Dump Trucks

1. Two 12-yard dump trucks worked in the area from 1130 to 1600 hours. One additional 12-yard dump truck and two 6-yard dump trucks worked in the area from 1400 to 1600 hours.
2. The trucks moved with the end of the loader conveyor belt until a full load was acquired. The dirt was taken approximately 1500 feet southwest of the Greenhouse and dumped.
3. The loading operation created extremely dusty conditions around and in the truck cabs. No anti-contamination clothing or respirators were worn by truck drivers.
4. After dumping the contaminated dirt, the trucks were loaded with uncontaminated dirt at a location adjacent to the highway and approximately one mile south of the 9-300 Bunker.
5. Fill dirt was dumped in both scraped and unscraped areas and in piles against the west side of the Greenhouse (four feet high). See Figure A. 1.
6. Six loads of contaminated dirt were removed from the area (estimated 72 cubic yards), and 34 loads of fill dirt were dumped in the area (estimated 342 cubic yards).

E. Use of Water Truck

1. The 2500 gallon capacity water truck first entered the area at 1035 hours, stayed in the area one-half hour on each of four trips, and finished at 1700 hours.
2. Water was sprayed over the area on the first three trips to minimize dust and on the last trip to settle the fill dirt.
3. The driver wore no anti-contamination clothing or equipment.

F. Samples and Surveys

1. At 1000 hours, Rad-Safe personnel conducted a gamma survey of the area with an AN/PDR 39 instrument at ground contact and at waist levels.
2. Readings were taken at four 50-foot intervals on six radial lines away from the Green house. Readings were also taken at the corners of the 60 x 60-foot oiled pad and around the Greenhouse.
3. Readings were taken at ground contact and at waist levels over scraped, scraped and filled, filled, and untouched surfaces throughout the decontamination operation.
4. Air samples were taken before decontamination began, during the scraping phase, during the loading phase and after decontamination.
5. Filter paper swipes were taken from the grader, the loader and two dump trucks.
6. Representative readings were taken in the area at the completion of the decontamination operation.

III. After Decontamination

A. Radiation Levels

1. Scraping to a depth of six inches reduced the ground contact dose rate from 120 mr/hr to 25 mr/hr and the waist level dose rate from 105 mr/hr to 40 mr/hr.
2. Filling with eight inches of "clean" dirt over surface that had not been scraped lowered the ground contact dose rate from 120 mr/hr to 20 mr/hr and the waist level dose rate from 105 mr/hr to 35 mr/hr.
3. Readings over surfaces that had been scraped to a depth of six inches and filled with eight inches of "clean" dirt showed a reduction of dose rate at ground contact from 120 mr/hr to 14 mr/hr and at waist level from 105 mr/hr to 20 mr/hr.

B. Personnel Dosages

1. Decontamination personnel were exposed to an average dose rate of 48 mr/hr as determined by evaluated film badges.
2. The grader operator received the highest dosage (320 mr) during six and one-half hours work in the area. His average dose rate was 49 mr/hr.
3. The loader operator and truck drivers accrued dosage at the highest rate (58 to 76 mr/hr).
4. The Rad-Safe monitor who spent the first two hours of decontamination in the area accrued dosage at a rate of 53 mr/hr, while the three laborers who spent the last two hours in the area accrued dosage at the rate of 38 mr/hr.

2.2 ? (see bottom of p. 5)

C. Air Concentrations

1. At the Nevada Test Site, respirators are required above 22.2 x 10^4 d/m per M^3 beta-plus-gamma concentrations in air.
2. Evaluated air samples indicated the highest concentrations of air-borne contamination existed during the loader operation.
3. During the loader operation, the beta-plus-gamma concentration was 5.3 x 10^4 d/m per M^3 at a sampling station approximately 100 feet downwind.

D. Equipment Contamination

1. Evaluated filter paper swipes of decontamination equipment revealed surface contamination below permissible levels.
2. No beta-plus-gamma activity above background was noted on equipment by survey with portable instruments.

IV. Table of Information

A. Radiation Levels

1. Before decontamination, gamma levels measured with AN/PDR-39 instruments on radial lines away from the Greenhouse were as follows:

Instrument Height	Distance Feet	Readings in mr/hr on lines					
		SW	W	N	NE	E	S
Contact	50	110	100	110	100	130	120
Waist		100	90	80	90	90	110
Contact	100	100	120	130	100	130	140
Waist		90	110	110	90	110	100
Contact	150	100	110	130	150	130	160
Waist		90	100	110	130	110	100
Contact	175	90	110	120	160		80
Waist		80	100	110	140		100

Contact Average 120 mr/hr
Waist Average 105 mr/hr

2. Average gamma levels taken with AN/PDR-39 instruments after decontamination were as follows:

Type of Decontamination	Level mr/hr	Instrument Height
Scraped to depth of 6"	40 25	Waist Level Contact
Filled to depth of 8"	35 20	Waist Level Contact
Scraped to 6" and filled 8"	20 14	Waist Level Contact

B. Film Badge Data

1. Dosages received by decontamination personnel as indicated by evaluated film badges were as follows:

Job	Total Dose mr	Time in Area hours	Average Dose Rate mr/hr
Monitor	220	5.5	40
Monitor	105	2.0	53
Monitor	170	4.0	43
Supt.	75	1.5	50
Foreman	220	5.5	40
Foreman	150	3.0	50
Operator	320	6.5	49
Operator	170	2.5	68
Driver	75	1.3	58
Driver	75	1.3	58
Driver	75	1.0	75
Driver	50	0.7	76
Driver		0.7	76
Laborer	150	3.0	50
Laborer	135	3.0	45
Laborer	150	3.0	50
Laborer	135	3.0	45
Laborer	75	2.0	38
Laborer	75	2.0	38
Laborer	75	2.0	38
		Total Average Lose Per Hour	48

C. Air Sample Data

1. Air samples taken during each phase of the decontamination operation were evaluated for beta-plus-gamma activity and the activity in d/m per M^3 was extrapolated to collection time.

Condition of Area	Beta Plus Gamma at Collection Time d/m per M^3
1. Before start of decontamination No one in area.	1.64×10^4
2. During Scraper Operation before wetting down.	1.33×10^4
3. During Scraper Operation after wetting down.	0.92×10^4
4. During Loader Operation. Very dusty.	$5.3 \times 10^{4*}$
5. After decontamination. No one in area.	1.32×10^4
* Respirators required above 2.2×10^4 d/m per M^3 at the Nevada Test Site.	

D. Equipment Swipes

1. Swipes taken from decontamination equipment in the area were evaluated for beta-plus-gamma activity within 24-hours.

2. Swipes were 4.5 inch diameter glass fiber filter papers rubbed over one square foot of surface area.

Swipe No.	Vehicle	AEC No.	Beta Plus Gamma d/m per ft^2
1.	Grader Cab	71206	Background
2.	Grader Body	71206	Background
3.	Grader Wheels	71206	Background
4.	Loader Cab	79061	Background
5.	Loader Body	79061	Background
6.	Loader Belt	79061	Background
7.	Dump Cab	20810	Background
8.	Dump Body	20810	Background
9.	Dump Cab	20923	Background
10.	Dump Body	20923	Background

Conclusions and Recommendations

A. Decontamination Methods (Mixed Fission Products Fallout)

1. Spraying water over contaminated dirt that is to be moved appears to be highly advantageous in reducing air-borne contamination.

2. All areas to be decontaminated should be scraped before filling. Less fill dirt will then be required to achieve the same lowering of radiation levels.

3. Operation of an automatic loader when the gamma radiation level of the dirt is above 100 mr/hr causes air-borne beta-gamma concentrations such that respirators should be worn.

4. Higher radiation intensities at waist level than at contact indicate that contaminated dirt surrounding the decontaminated area continues to effect the radiation level within the area.

B. Personnel Protection

1. The grader operator received 320 mr while working 6.5 hours in the area. Individual dosage can be lowered by changing operators periodically.

2. Dosages can be controlled more effectively by performing all scraping, loading and dumping before the fill is spread. Only a minimum number of persons should be allowed in the area until these phases are completed.

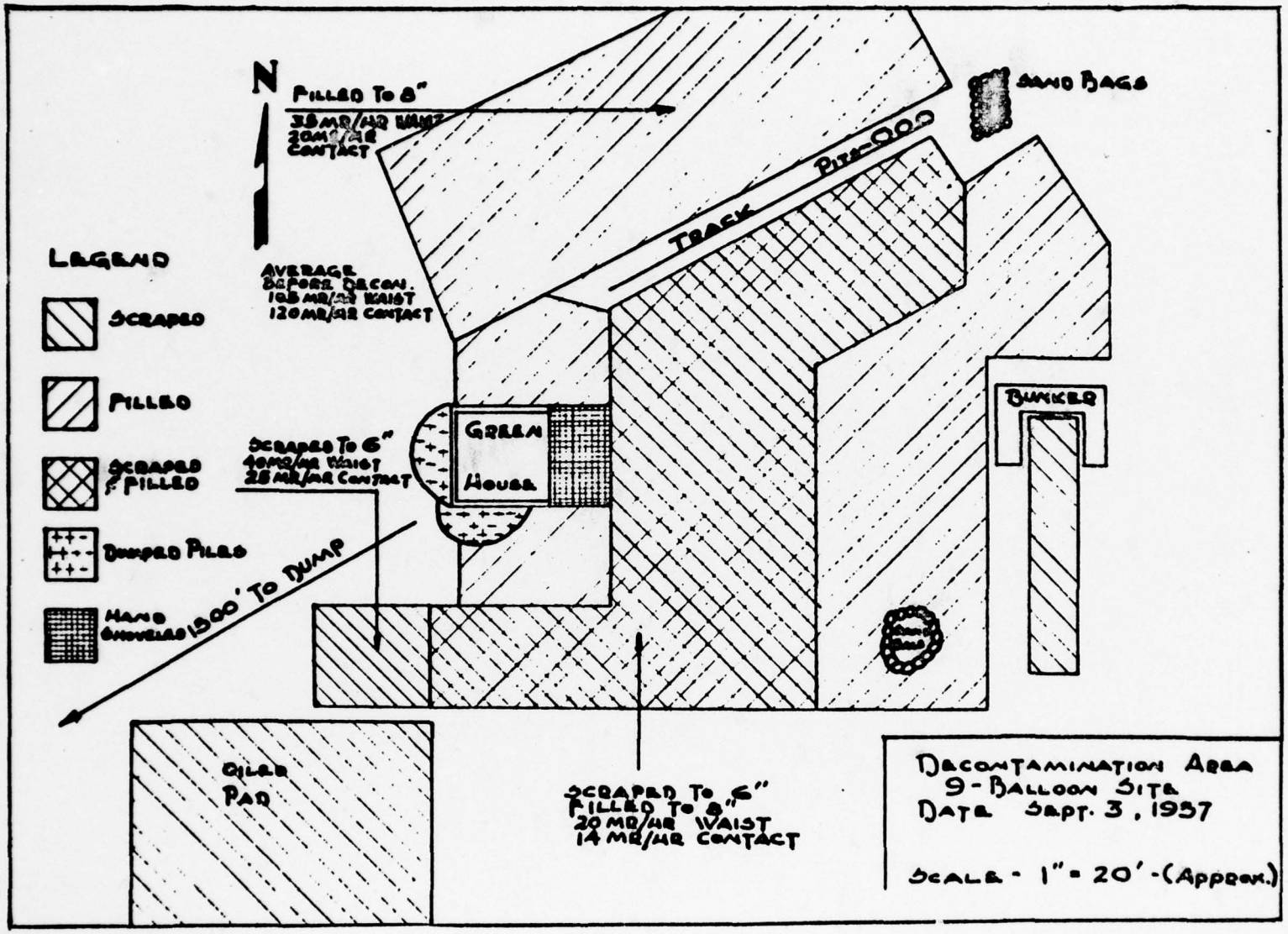

Figure A.1 Report on Decontamination of Area 9 Balloon Site

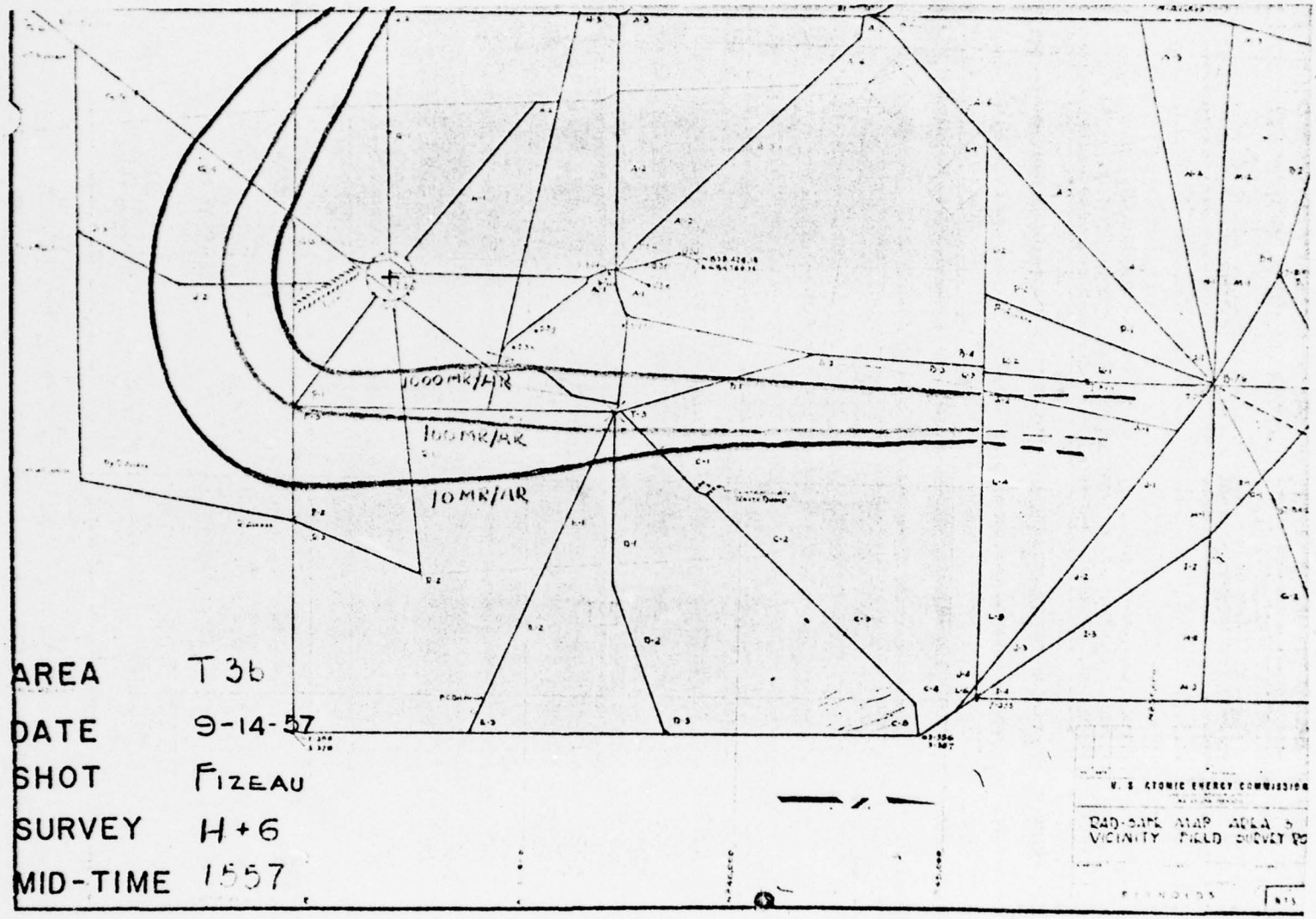

Figure 3.26.2 Fizeau, H + 6

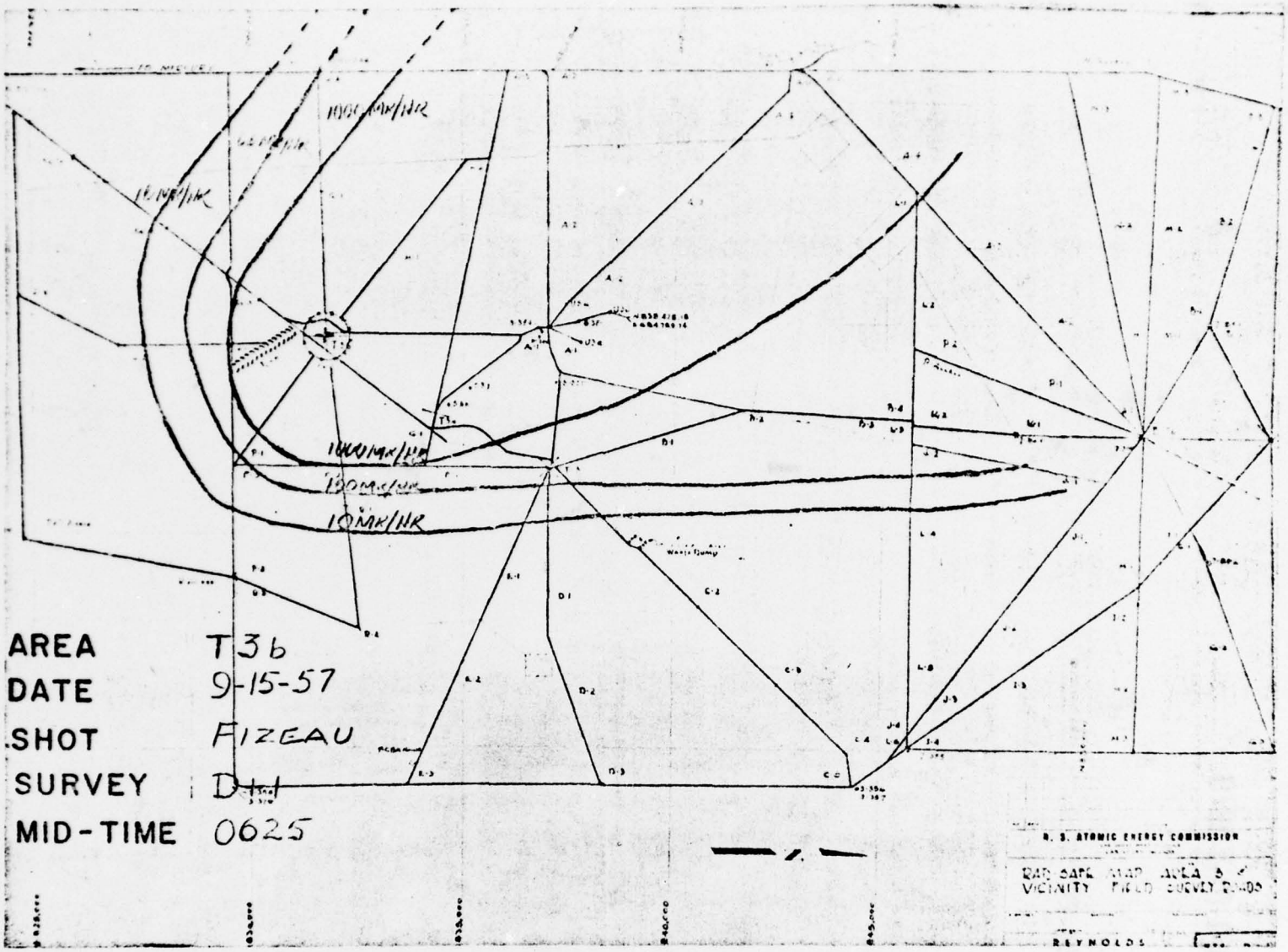

Figure 3.26.3 Fizeau, D + 1